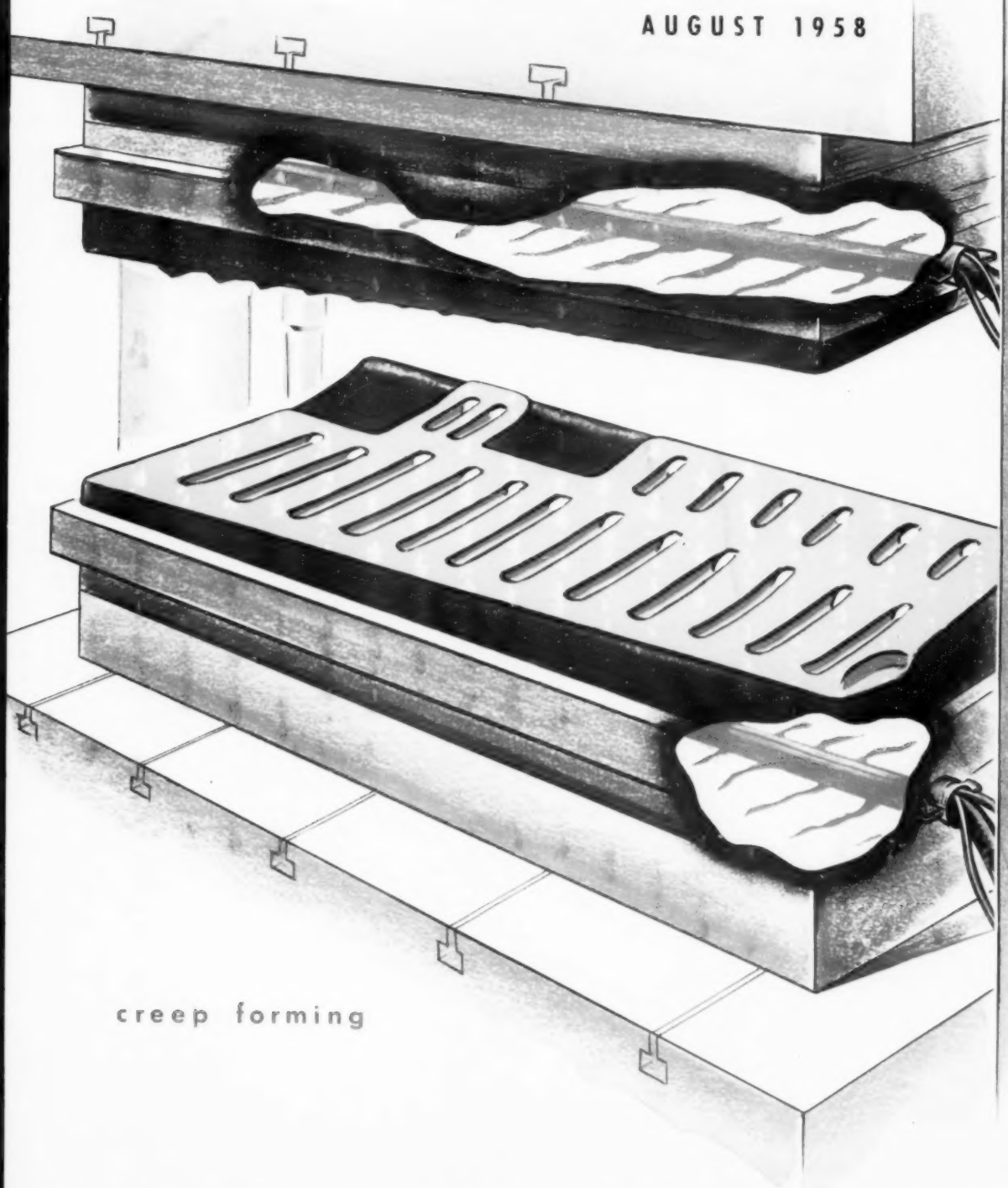
the

TOOL ENGINEER

AUGUST 1958



creep forming

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

it's mainly a matter of TIMING!

But how do you really KNOW when a machine has reached retirement age?

ANY machine tool could be made to last *forever* — if you kept on maintaining and repairing it forever. In fact, if you put enough money into its maintenance, you could keep it "good as new" indefinitely. But there's an economic limit to the maintenance money you can spend. And there also comes a time when "good as new" is no longer *good enough!*

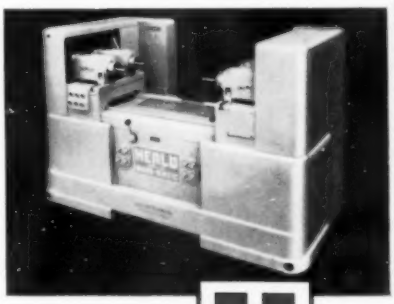
But, from the standpoint of production cost and return on investment, there *is* a mathematically predictable retirement age for any machine. Replacing it before this time is a waste of money. Retaining it *beyond* this time means a financial *loss* — often a substantial one!

Don't trust guesswork or rule-of-thumb computations to give you the right answer. There's too much money at stake.

Our sales engineers are well experienced in precise methods of replacement analysis. If you're in doubt — or would like to check your own figures — just call in your Heald engineer. He will be glad to help you. Similar obsolescence studies have effected many important savings.

For example: A diesel engine manufacturer asked for a replacement analysis on a 10-year-old boring machine, used to finish the I.D. of cam roller followers. It was found that a Model 322 Bore-Matic, like that shown at the right, would do the same job *50% faster*, with the following annual savings in operating cost:

	Old Machine	New Heald
Parts per hour	187	280
Parts per year (Req'd. Prod.)	374,000	374,000
Direct & Indirect Labor	$17,820	$9,400
Annual Maintenance	$750	$200
Annual Operating Cost	$18,570	$9,600
Annual Saving for New Machine		**$8,970**



YOU pay for obsolescence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

HEALD

the tool engineer

Vol. 41, No. 2 August 1958

Preparing Engineers for Industry.....*By Lyman L. Francis* 41
Do engineering students need more practical training? The author says they do, and suggests how industry can help them get it.

Gadgets..... 44
Method for facing convex and concave contours; gripping device for handling barstock; hole location gage.

Selecting and Maintaining Hydraulic Fluids.....*By C. R. Schmitt* 47
Most modern machines incorporate hydraulic power systems. To get the most out of these systems, fluids must be correctly applied.

Residual Grinding Stresses Can Be Minimized.....*By M. W. Gormly* 51
Grinding stresses can cause early failure of parts in service. The author discusses a grinding method that improves fatigue strength.

Measuring Scratches Accurately Reduces Rejects.....*By Bobly Siebel and Fred Miller* 55
An optical instrument developed by the authors makes it possible to measure the depth of scratches quickly and accurately.

Forming High-Strength Materials.....*By William W. Wood* 63
Titanium and stainless steel alloys can be formed without difficulty by using a new method—elevated temperature creep forming.

Interferometer Checks Gage Block Accuracy..... 70
A simple instrument, developed by the Bureau of Standards, will lead to greater precision in measurement by industry.

Equipment Leasing Conserves Working Capital.....*By Clarence C. Kane* 73
While equipment leasing may not be suitable for all companies, it does provide a means of modernizing a plant without tying up capital.

Costs Reduced by Integrated Welding and Machining.....*By J. H. Brems* 75
Performing machining and welding operations on the same machine is a significant forward step in automation.

Plastics Tooling Cuts Lead Time.....*By M. B. Newburger and H. B. Pawasarat* 80
Reinforced epoxy resins are used extensively for form dies, contour check tools, profile templates and milling fixtures.

Cold Treatment of Stainless Steel.....*By J. F. Baisch and C. E. Hover, Jr.* 87
Subzero processing improves material properties and, in some cases, can be used to obtain dimensional refinement on close-tolerance parts.

Specifying Undercuts and Reliefs (Reference Sheet).....*By Frank Zagar* 89
Company standards for undercuts and reliefs can save drawing time and insure that desired results are obtained in the shop.

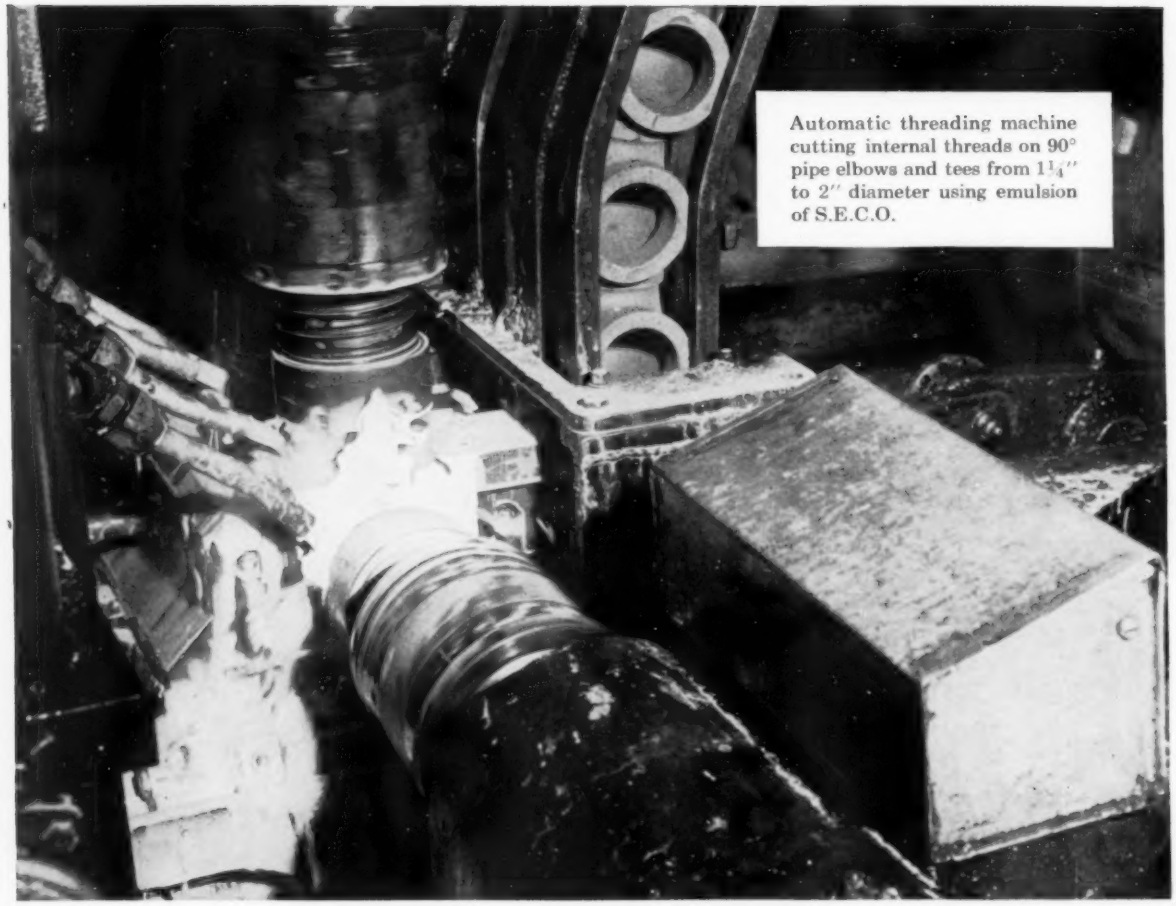
ASTE NEWS FEATURES..... 91

President's Editorial 39
Designed for Production 58
Field Notes 133
Good Reading 140
Letter from the Editor 3
Men at Work 139
Progress in Production 113
Readers' Viewpoints 143
Tech Digests 151
Technical Shorts 147
Tool Engineering in Europe 148
Tools at Work 82
Tools of Today—New Products 117
Trade Literature 144
Who's Meeting and Where 141

THIS MONTH'S COVER

Using electrically heated dies, Chance Vought manufacturing research engineers have been able to form high-temperature materials without buckling, springback or tearing. Details of the method are given in an article beginning on page 63.

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Industrial Arts Index*.



Automatic threading machine cutting internal threads on 90° pipe elbows and tees from $1\frac{1}{4}$" to 2" diameter using emulsion of S.E.C.O.

Photo courtesy of Grinnell Corporation

EMULSIONS OF NEW S.E.C.O. WITH SMALLER OIL-PARTICLE SIZE CUT PRODUCTION COSTS

There's a new and greatly improved S.E.C.O. (Sunoco® Emulsifying Cutting Oil), that has smaller emulsion-particle size to give you the following benefits:

- BETTER PROTECTION AGAINST RUST, even at emulsion ratios as lean as 40-to-1.
- BETTER DETERGENCY, which permits dirt and fines to settle quickly out of emulsions, leaving machines clean.
- BETTER EMULSION STABILITY. Even in hard-water areas, emulsions of *new* S.E.C.O. stand up better than those made with other regular emulsifying cutting oils.
- BETTER FINISHES, CLOSER TOLERANCES. New S.E.C.O., with better coverage and wetting of work, produces consistently finer finishes in machining. Reject rate falls off. Tool life increases.

TRY *NEW* S.E.C.O.—for increased economy in all machining operations. Ask your Sun representative, or write to Department TE-8.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

© 1958 SUN OIL COMPANY

In Canada: Sun Oil Company Limited, Toronto and Montreal

Harry E. Conrad
Executive Secretary
Allan Ray Putnam
Publishing Manager

Editorial

John W. Greve
Editor
Theodore W. Black
Senior Associate Editor
Robert W. Reinhardt
Assistant Editor
J. Frederick Parr
Assistant Editor
Dorothy J. Taylor
Assistant Editor
M. L. Stone
News Editor
Suzanne Olson
Associate News Editor
Michael Babala
Art Editor
F. Latitia Pierce
Assistant Art Editor
Virginia Kuczynski
Editorial Assistant

Business

Michael Jakesy
Business Manager
Clarence T. Etter
Advertising Manager
Austin G. Cragg
Eastern Advertising Mgr.
400 Madison Ave.
New York 17, N. Y.
Francis Baldwin
Middle Atlantic Adv. Mgr.
400 Madison Ave.
New York 17, N. Y.
Richard E. Cleary
Ohio Advertising Mgr.
15515 Detroit Ave.
Cleveland 7, Ohio
R. Alan Cobleigh
Michigan Advertising Mgr.
10700 Puritan Ave.
Detroit 38, Mich.
Stanley F. Girard
Western Advertising Mgr.
612 North Michigan Ave.
Chicago 11, Ill.
Robert E. Ahrensdorf
Pacific Coast Adv. Mgr.
5720 Wilshire Blvd.
Los Angeles 36, Calif.
Marjorie A. Hunt
Circulation Manager

THE TOOL ENGINEER

Editorial & Business Offices
10700 Puritan Ave.
Detroit 38, Mich.

Publication Office:
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly in the interest of members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the act of March 3, 1879. Yearly subscription: members $2.00; nonmembers, $6.00; Canada, $6.50, and all other countries, $8.00. Copyright 1958, American Society of Tool Engineers.

Progress Makes Obsolescence

In this fast moving industrial world, "obsolete" has been used to describe anything that works. Thanks to our productive resourcefulness, this statement has been more or less true. When a new design has been debugged and put into production, a better design is already on the drawing boards. The tool engineer, whether planning to produce the product or use it as a production tool, has an opportunity to reappraise his methods of production.

This dynamic condition accounts for our increasing rates of production and is responsible for our industrial leadership. It has made us the envy of the world. As long as we seek and develop better methods, our leadership will remain secure.

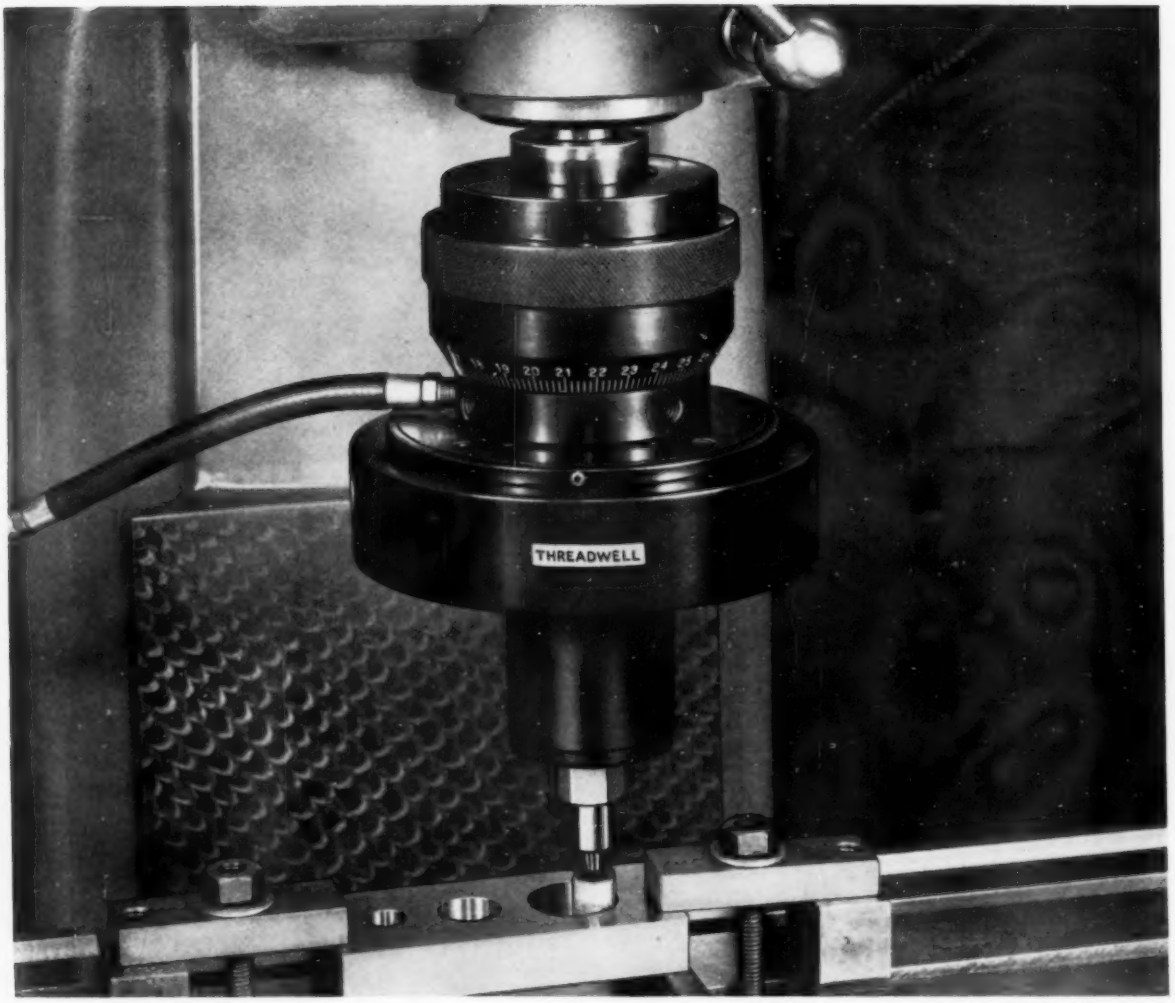
When a machine tool is being replaced, it is expected that the new tool will not only operate at a higher rate but also hold closer tolerances and reduce operator fatigue or minimize manual variables. Such benefits are taken for granted. Plans for production and estimates of costs are based upon these improvement factors.

Fortunately, improvements are not restricted to mass production. Many engineers, however, believe this to be true insofar as automation is concerned. They think in terms of in-line transfer machines where large quantity lots are necessary for economical tooling. Instead, template machining or tape-controlled programming are typical methods that promise better production of limited-quantity lots.

Experience and judgment together with accurate data on production lots are required to effectively utilize improved methods. As more refinements become available and as new processes are developed, the resourcefulness of the tool engineer becomes more and more important. Then, adding the possibilities through product redesign and product improvements, the responsibilities for being well-informed are vast. The stakes are high and the dividends are worthwhile.

John W Greve

EDITOR



Threadwell

GRIND-A-MATIC

provides jig grinder performance at drill press prices

The new Grind-A-Matic is an air turbine grinding head which can be mounted either vertically or horizontally on almost any machine tool.

Its versatile application and high precision performance allow Grind-A-Matic to perform grinding operations normally done on an expensive jig grinder. Mounted the same as any standard tool, it becomes a close tolerance grinder for such work as internal grinding of tools, dies and fixtures.

- *Fine radial adjustment from "0" to .070" while the spindle is rotating.*
- *Uninterrupted precision grinding*
- *Coarse adjustment from "0" through 1¼"*
- *Spindle speeds from 50 to 75,000 RPM*
- *Standard range from ⅛" to 2½" holes*
- *Adapted to include holes up to 5½"*
- *Sealed air turbine and spindle bearings*

Write today for complete information on this versatile grinding head

THREADWELL TAP & DIE COMPANY Greenfield, Mass., U.S.A.

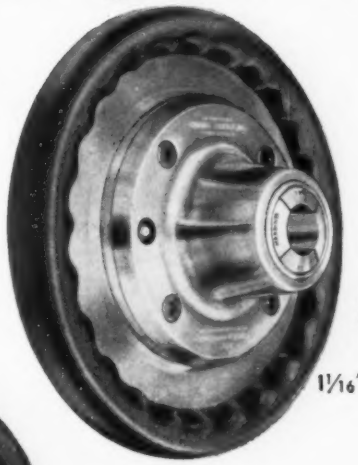
HARDINGE
ELMIRA, N.Y.

HARDINGE Sjogren Chucks

Quality at Low Cost

HARDINGE-SJOGREN Speed Collet Chucks for tool room lathes, engine lathes and grinders.

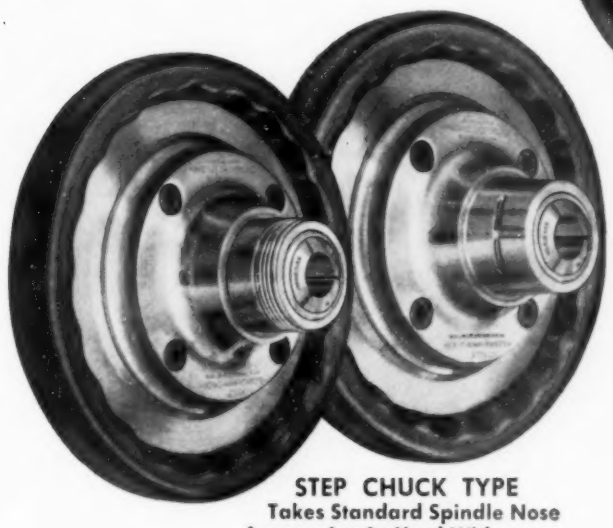
Available for Threaded Nose, Cam Lock, Taper Key Drive and American Standard Spindles.



REGULAR TYPE

AVAILABLE IN FIVE COLLET CAPACITY SIZES

1 1/16", 1 3/8", 1 3/4", 2 1/4", 3 1/2"



STEP CHUCK TYPE
Takes Standard Spindle Nose Accessories As Used With Hardinge Precision Machines

LEVER TYPE

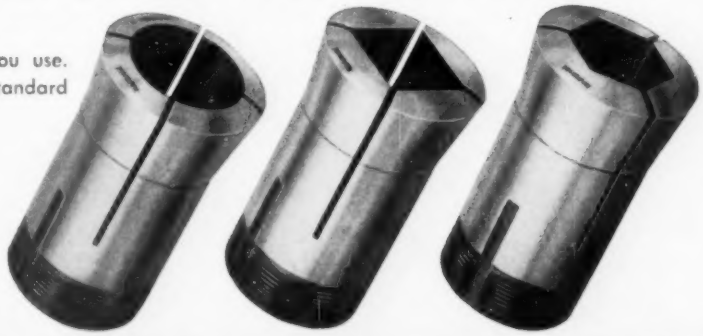
Ask Your Hardinge Representative or Local Distributor For Bulletin 88

HARDINGE
ELMIRA, N.Y.

HARDINGE Low Cost Steel Collets

Maximum efficiency — Pay for only what you use. Records show that 82% of all sizes used are standard 16th sizes.

Buy only the sizes you use — Hardinge Collet stocks are available in Atlanta, Boston, Hartford, New York, Philadelphia, Rochester, Dayton, Detroit, Chicago, St. Louis, Minneapolis and Los Angeles. Also, Toronto and Montreal, Canada.



HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.

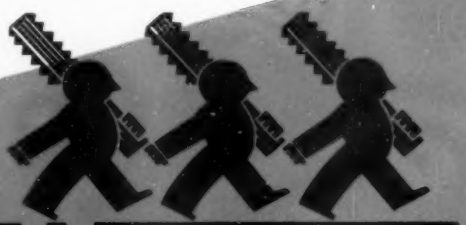
The right Tap for every job—and every one with BALANCED ACTION

Whether it's a standard tap or a tap for special application, every size and type in Winter's complete line gives you a higher production potential because of famous Winter quality. Only Winter Taps perform with Balanced Action—your guarantee of high hole accuracy, trouble-free operation and long tool life.

GAGES AND DIES

The same excellence in design and construction can be yours in Winter Plug and Ring Gages, thread or plain; Adjustable and Solid Thread Dies.

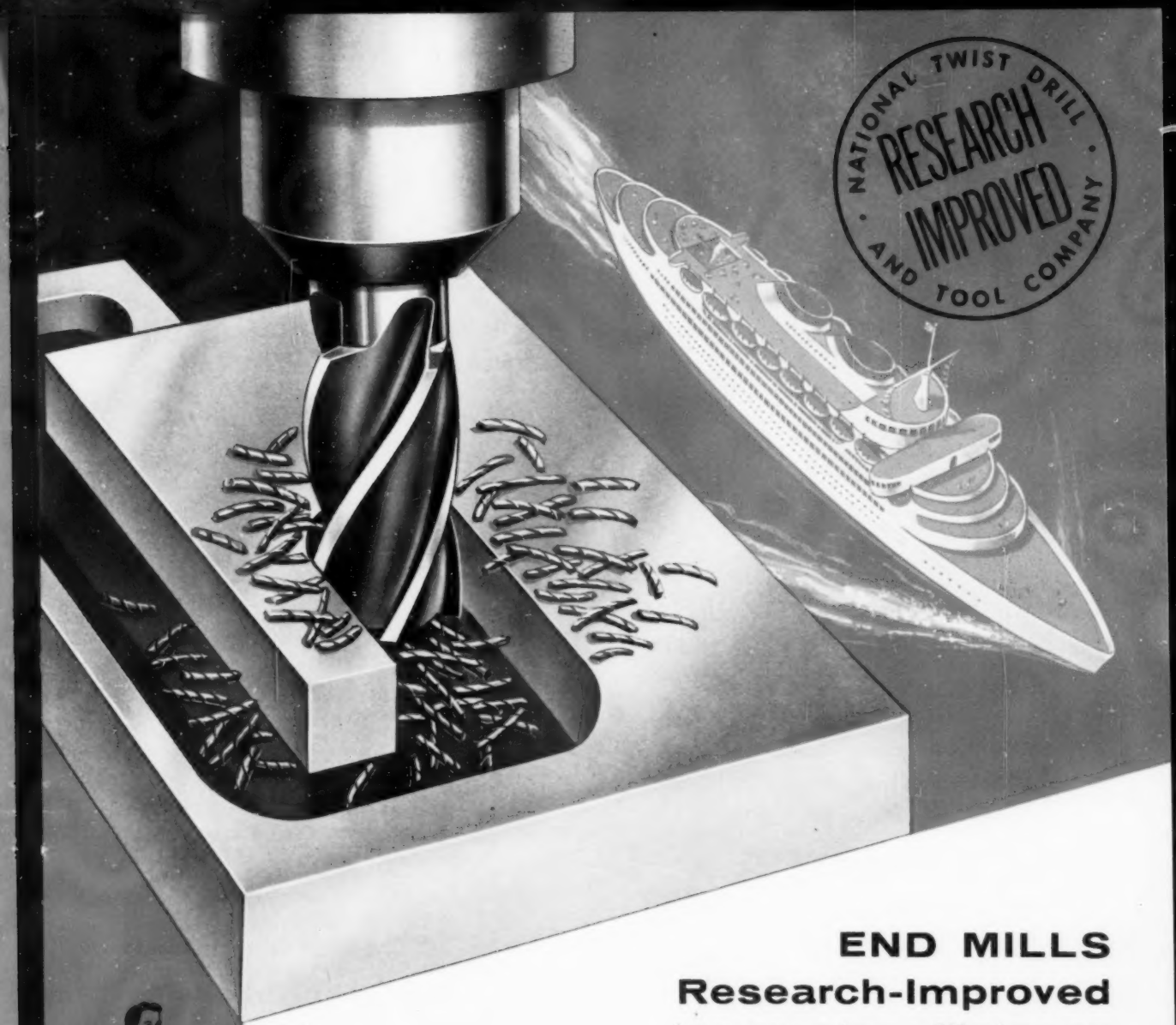
CALL YOUR DISTRIBUTOR
for standard and special WINTER Balanced Action Taps, Dies, and Gages.



WINTER

WINTER BROTHERS COMPANY
Rochester, Michigan, U.S.A.

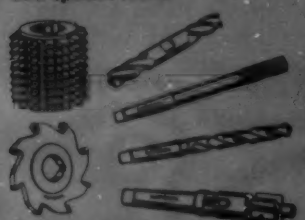
Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles •
Division of National Twist Drill & Tool Co.



END MILLS
Research-Improved for greater efficiency

"Helex" End Mills, one of the most versatile and efficient series in the National line, are Research-Improved for higher cutting speeds and higher feeds. Available for soft or hard metals, in a variety of sizes and styles—high speed steel or carbide. In toolroom or production operation, National End Mills give you precision milling of slots, keyways and pockets—*fast* . . . You profit by National's continuing search for better ways of cutting metals.

CALL YOUR DISTRIBUTOR for **NATIONAL** twist drills, reamers, counterbores, milling cutters, end mills, hobs, carbide and special tools.

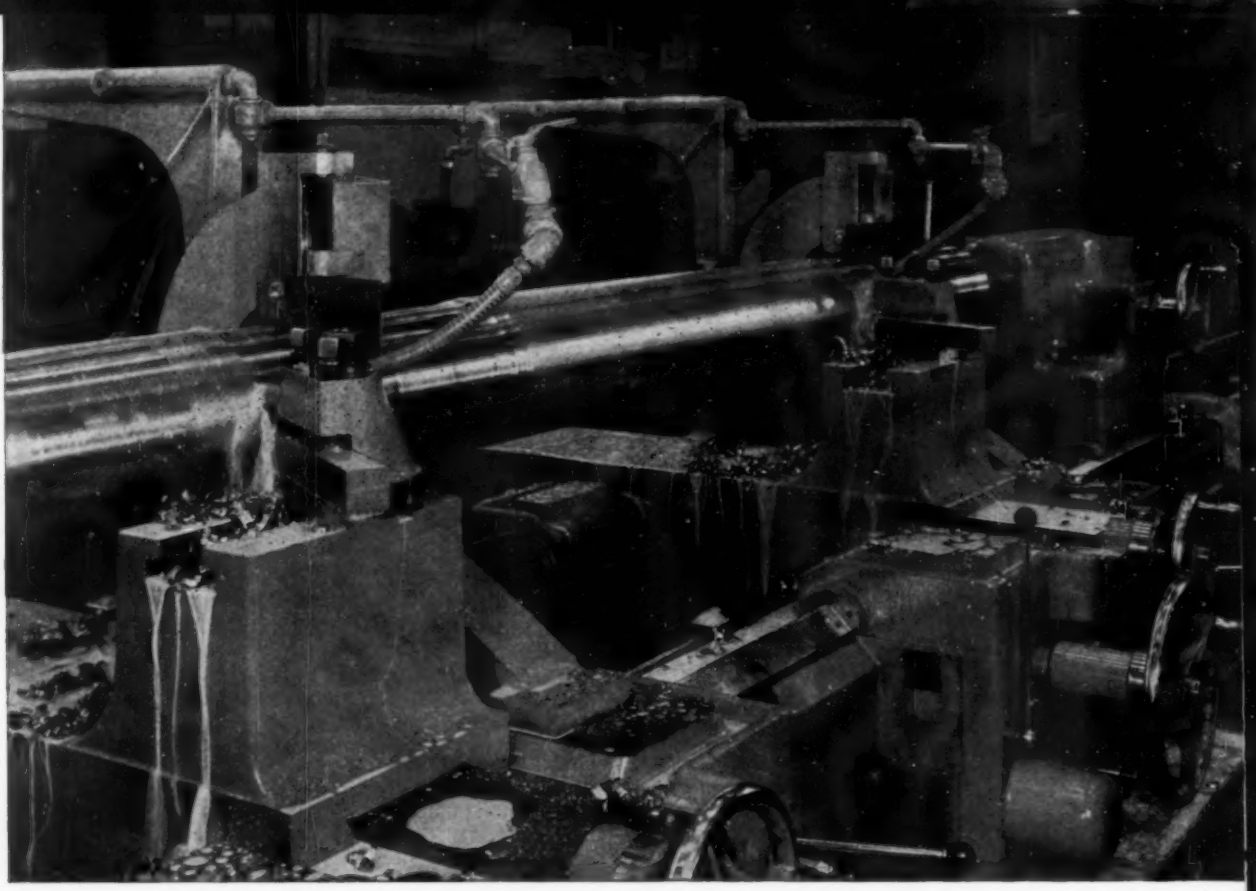


NATIONAL TWIST DRILL & TOOL © ROCHESTER, MICH. U.S.A.

National

NATIONAL TWIST DRILL AND TOOL COMPANY **Rochester, Michigan, U.S.A.**

Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles



Cutting with two Carriages equipped with plain block rests and follow rests.

MACHINING TITANIUM BILLETS

32 inch "American" Double Carriage Pacemaker Lathe.

An extremely difficult job — a real challenge to the rigidity, stamina and "staying" qualities of any lathe.

Cutting titanium offers terrific resistance to the cutting tool which in turn demands maximum rigidity of the tool supporting members in order to hold vibration to the very minimum; otherwise chatter and high tool mortality are inevitable.

The fact that all of the major titanium fabricators are using "AMERICAN" Lathes, selected only after repeated demonstrations, is conclusive testimony to the power, stamina and rigidity of these machines.

There are exclusive features which definitely contribute to this result, such as the wide, four vee bed with walls rigidly tied together between the girths by an angular web which forms a chute for quick disposal of chips; replaceable hardened tool steel vees; solid 3-vee mounting of the carriage on the bed; powerful headstock with triple bearing spindle and bearing adjustment from the outside and others which space limitations prevent mentioning.

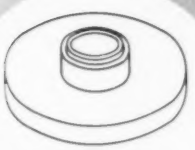
For a complete description of all of these features just send for bulletin No. 144.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U.S.A.

LATHES AND RADIAL DRILLS

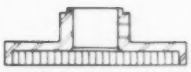
Bodine

CASE HISTORY NO. 48...



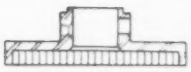
Hand load blank to fixture-type dial. Auto inspect and clamp.

1



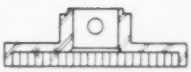
Drill .173" dia. one side. Horizontal drill spindle.

2



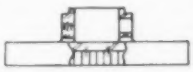
Drill .116" dia. 2nd side and chamfer. Combination tool. Horizontal drill spindle.

3



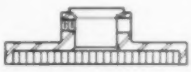
Drill .187" dia. hole through. Vertical drill spindle.

4



Tap #6-40 CL 3 hole to size. Horizontal tap spindle. ALSO drill .187" dia. hole. Vertical drill spindle.

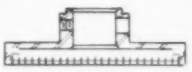
5



Countersink .430" dia. with Welden 90° c/sink. Vertical drill spindle.

Auto inspect for broken drills or taps.

6

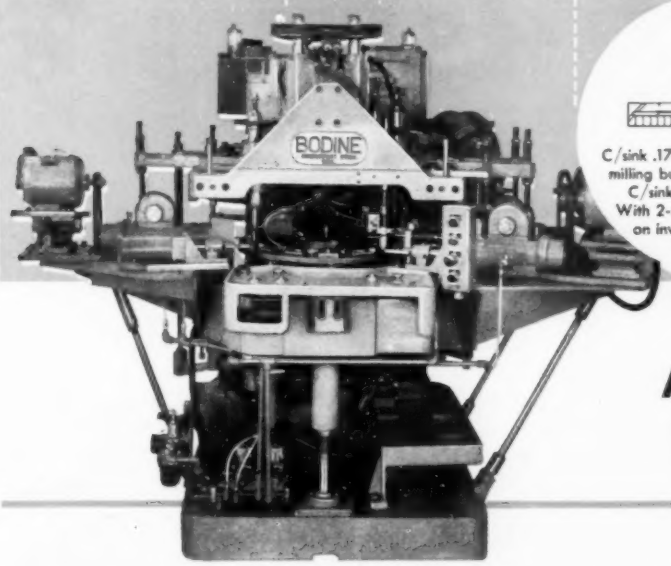


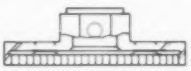
Undercut teeth using special recessing tool. Inverted drill spindle. (Hold down vertically.)

7

Gang mill .062" slot and flat. Vertical milling spindle.

8





C/sink .173" dia. hole to remove milling burr. Horiz. drill spindle. C/sink 2 .187" dia. holes. With 2-spindle multiple-head on inverted drill spindle.

9

Ream .430" dia. to remove burr. Vertical drill spindle.

10

All this and better QUALITY CONTROL too!

PART and MATERIAL: Clutch drum, steel B1117

PRODUCTION: 4200 operations (300 pieces completed) per 50 min. hour.

The remarkable versatility of Bodine Basic Machines and tooling methods is well illustrated by this recently completed unit for Teletype Corporation. Production, however, is only part of the story. Superior *quality control* was the main reason for development of this new production method for Teletype.

The part is a steel clutch drum on which no less than 14 *operations* are performed, with two automatic inspections built into the cycle.

There are 4 vertical drill spindles and 1 vertical milling spindle; 3 horizontal drill spindles and 1 horizontal tap spindle; 2 inverted drill spindles. Parts are hand-loaded but automatically ejected. The station is washed after ejection.

Just think what it means in the production of a part like this when one compact machine and one easily maintained set of tooling can handle *4200 operations* per hour to close limits, plus control inspections. Yet this is only one of many outstanding examples of Bodine practical aid to cost or quality-troubled manufacturers. Send us your next tough job . . . parts or prints . . . for production analysis. Write Dept. TE-8.

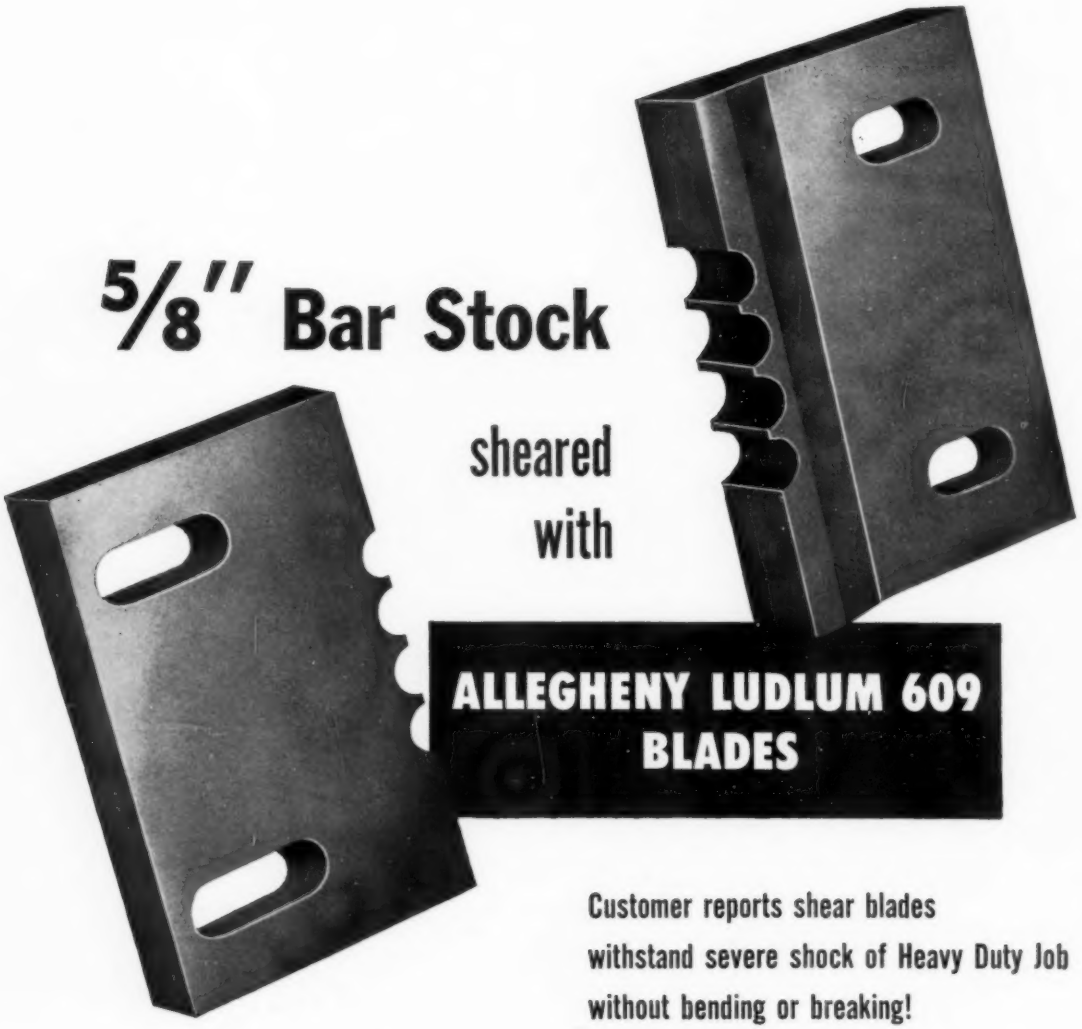
THE **Bodine** CORPORATION

BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

2BD58

5/8" Bar Stock sheared with ALLEGHENY LUDLUM 609 BLADES



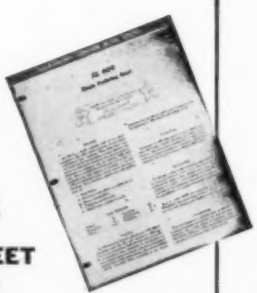
Customer reports shear blades withstand severe shock of Heavy Duty Job without bending or breaking!

A Birmingham manufacturer finds that A-L 609 blades take the tough job of shearing ⅛" bar stock in stride. A high elastic limit and fair ductility at comparatively high degrees of hardness give these silico-manganese steel blades the ability to withstand heavy shock without bending or breaking.

Besides superior shock resistance, A-L 609 has the advantages of excellent hardenability in larger sections combined with a fine grain size. Characteristics like these make 609 particularly suitable for tools that must withstand severe service. Such applications include shear blades, pneumatic tools, heavy duty punches, shanks for carbide tools, and machine parts exposed to severe shocks.

For the finest in tool steels and technical assistance to help solve your tool or die steel problems, call your A-L representative or distributor today . . or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*

For nearest representative, consult Yellow Section of your telephone book.



Write for

BLUE SHEET on AL 609

A compilation of facts on the handling and shop treatment of A-L 609. Includes complete information on forging, annealing, hardening, tempering, etc., and detailed laboratory data on physical characteristics. *Ask for your free copy.*

ADDRESS DEPT. TE-8

For complete **MODERN** Tooling, call

Allegheny Ludlum

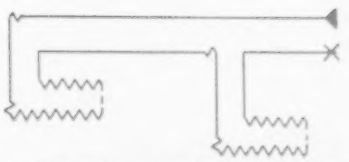
WSW 6624

AL FINE TOOL STEELS SINCE 1854

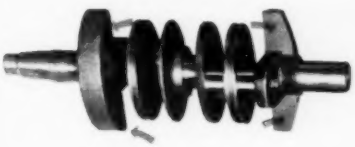
Counterweight Pads on opposite ends of Crankshaft... milled in one

POWERMATIC under and over cycle

Four crankshaft counterweight pads are automatically milled in one cycle on this CINCINNATI equipped Powermatic Milling Machine. The fixture is constructed in three sections to accommodate two sizes of crankshafts.



"Under and over" cycle incorporated in CINCINNATI Powermatic Milling Machine, to mill four counterweight pads on crankshaft. This cycle greatly simplifies tooling.



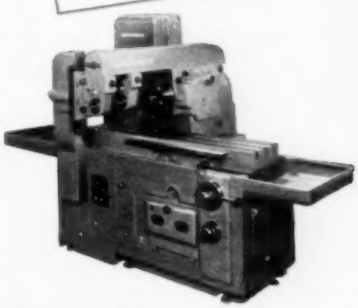
Photograph of part. Arrows indicate the counterweight pads.

Production data:

Part name	crankshaft
Material	steel forging
Operation	mill four counterweight pads
Estimated production	32 per hour at 80% efficiency

Machining operations on crankshafts are always special problems. Consider the counterweight pads, for example, and the several methods by which they could be machined. Cincinnati's Engineering Service specialists devised a unique short-cut method wherein four pads are milled **under** and **over** in pairs, in one automatic cycle. A CINCINNATI Powermatic Rise-and-Fall Milling Machine, equipped with a minimum of extras, handles the job efficiently and at the lowest cost. ¶ A duplex spindle attachment takes care of the pads on the off side of the crankshaft. Two working heights of the spindle carrier are required to mill two pairs of pads, as indicated in the headline drawing. The entire cycle, diagramed below, is controlled by a simple cycle selector, actually a small cam assembly interchangeable in a minute or two with standard Powermatic cycle selectors. ¶ CINCINNATI Milling Machines and Engineering Service have put hundreds of difficult and unusual milling operations on the road to lower cost. This world-renowned team can do as much for you. Just tell us about your machining problems related to milling and broaching; we will work out the solution.

CINCINNATI POWERMATIC Rise-and-Fall MILLING MACHINE
Catalog M-1913-2



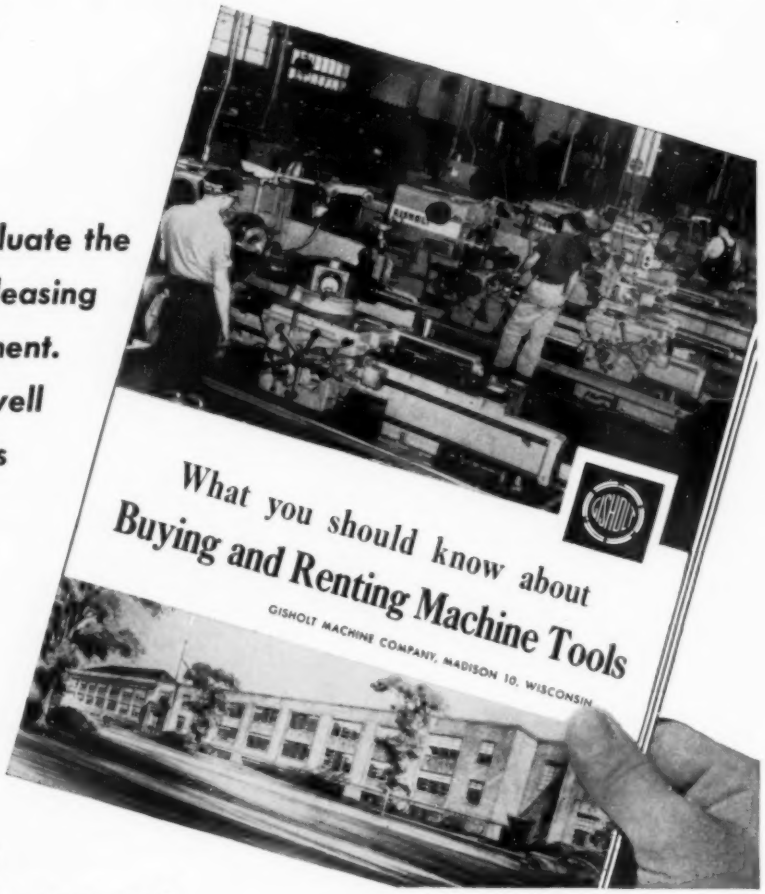
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI®

Knee Type Milling Machines • Bed Type Milling Machines • Die Sinking Machines
Cutter and Tool Grinders

Can your competitors turn metal at lower costs?

***Now** is the time to re-evaluate the possibilities offered by leasing of new production equipment. Your decision today can well determine your company's position in tomorrow's competitive market.*



This free booklet tells how you can get new machines with minimum capital outlay

If you have delayed replacing old machines because of the relatively large capital investment, acquisition by methods other than outright purchase may solve your problems. Only a minimum initial investment provides you with the many competitive advantages that new machines offer, including greater accuracy, higher production rates and faster setup. New features and accessories simplify even the toughest jobs. Secondary operations are minimized and spoiled work becomes a thing of the past. All this means lower unit cost—more profit for you.

If you want the benefits that new machine tools can provide, and if you like the idea of letting them "pay their way" while they "turn" a profit for you, you'll want to write for Gisholt Bulletin 1173 on buying and renting machine tools. It fully explains one of the most liberal and comprehensive policies in the industry, and covers several types of leasing and time payment plans with vital information on depreciation, tax angles, the MAPI formula and other timely questions. The coupon will bring your free copy. Send it along today.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW-MACHINE GUARANTEE

Gisholt Machine Company
1227 E. Washington Ave.
Madison 10, Wisconsin

Without obligation, please send your Bulletin 1173.

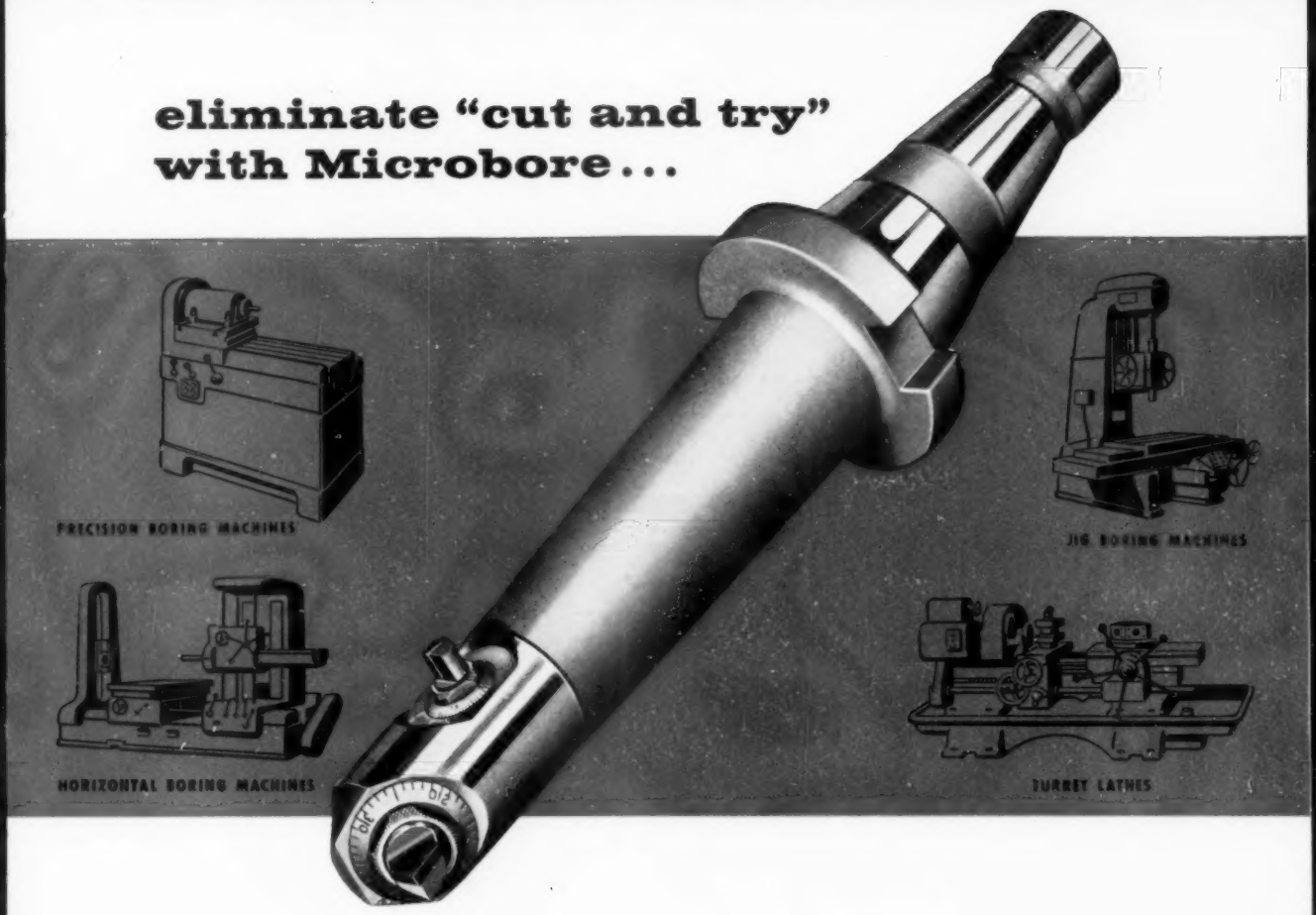
Name.....*Title*.....

Company.....

Street address.....

City.....*Zone*.....*State*.....

eliminate "cut and try" with Microbore...



...THE TOOL THAT ADJUSTS PRECISELY IN SECONDS!

YES, EVERY TIME—ALL THE TIME! In seconds, with our proven micrometer vernier adjustment, any operator who can read a "mike" can adjust a Microbore Tool for precision boring to extremely close tolerances.

Any production man knows what that means. Elimination of wasteful down time. Greater productivity of men and machines. Fewer rejects. Better parts due to holding closer tolerances.

It just makes good sense to *Modernize with Microbore*. A few dollars so invested can increase the productivity of a machine costing thousands.

Microbore units can also be applied in clusters for special tooling designed for high production applications.

A wide range of Microbore Boring Bars with NMTB taper, Morse taper, Flash-Change and Straight Shanks are available singly or in complete sets. Standard set includes Microbore units for each tool station, grinding blocks and necessary wrenches, in a fitted hardwood case.

• As the first step in eliminating your own costly "cut and try" methods, write for Microbore Catalog No. 56.

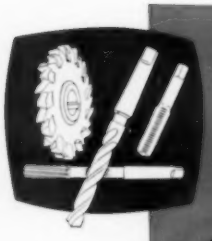
DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

GUTS

that's what business



MORSE
means
"THE MOST"
in Cutting Tools

NOT CUTS

needs Right Now!

This is to reassure you that your Morse-Franchised Distributor is in business just as solidly and strongly as ever.

For, regardless of conditions, Morse is continuing to support him 100% in deliveries, sales engineering and sales promotion.

There will be no cutbacks from Morse in any way.

So you can continue to depend on your Morse-Franchised Distributor for the same 100% service he has *always* given you. *Call him in today!*

MORSE TWIST DRILL & MACHINE CO.
NEW BEDFORD, MASS.

A Division of VAN NORMAN INDUSTRIES, INC.

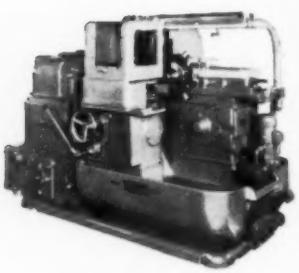
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

DO YOU NEED FLEXIBILITY?

TAREX HAS IT

...AND HERE'S HOW!

The illustration shows a Tar-H Machine with 2-9/16" bar capacity, 7" dia. chucking capacity, and...

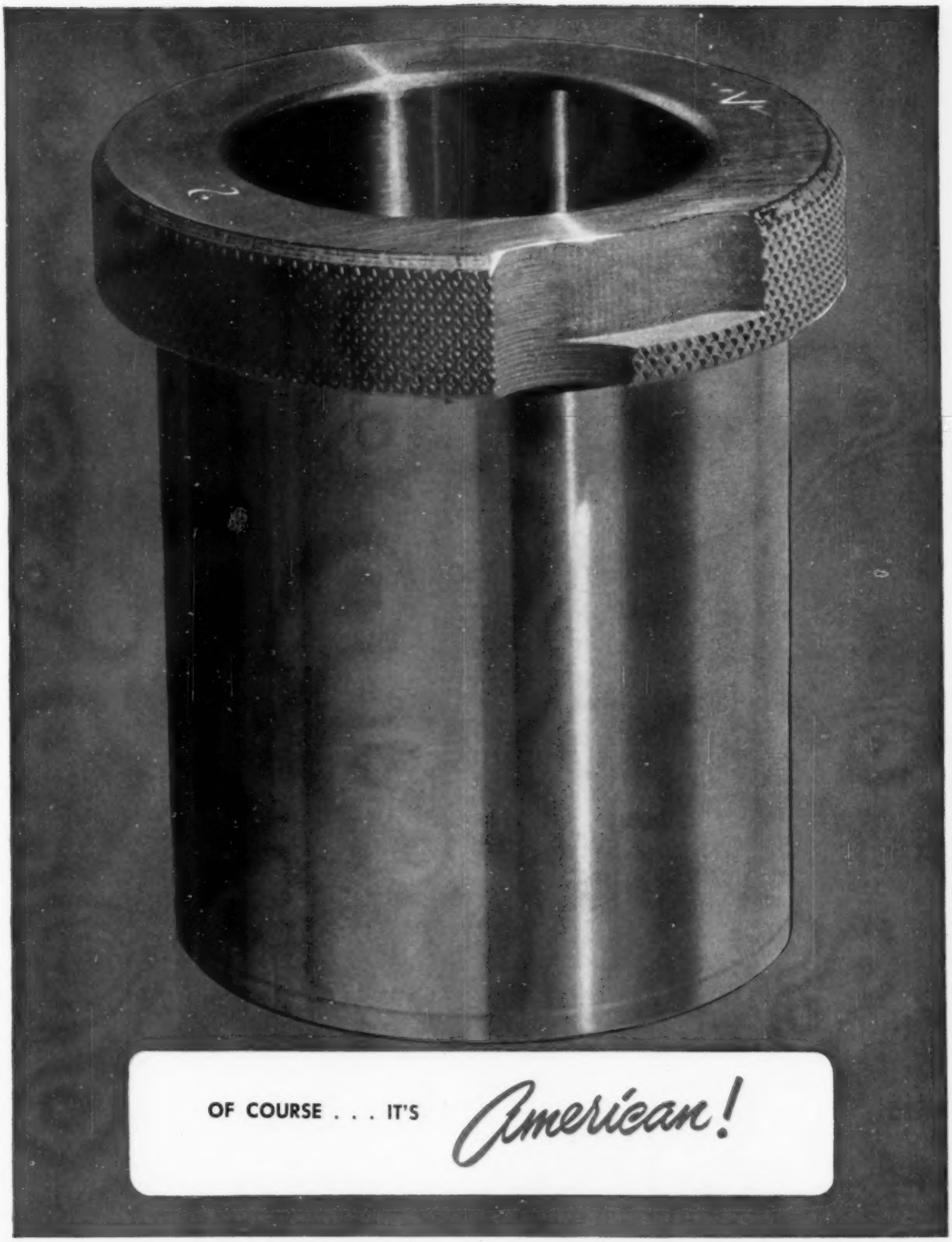


- A front slide with length- and cross-wise feed, using standard camming
- A rear slide that will single point angles up to 30°
- Two vertical slides
- A hydraulic tracing unit that will generate irregular sufaces with single point tools
- A multiple drillhead with drill speeding feature, spindle brake and positioning
- An 8-position turret

ALL THESE FEATURES, AND OTHERS, VARIABLE AT WILL!

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

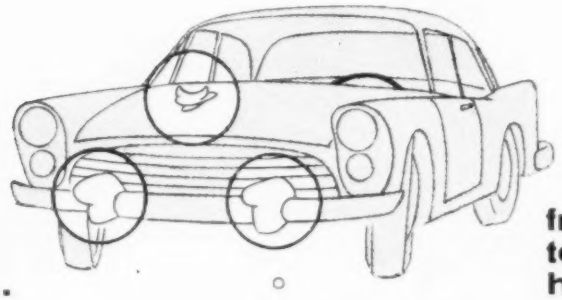


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-17

HY-PRO specialists will show you how a little difference in design can deliver

100 times longer tap life

The jobs where tap life can be increased a hundredfold are obviously exceptional, but it *can* happen, as these cases prove, even in the cost-wise automobile industry. That's why it pays to question tap costs on any job. Job analysis by HY-PRO specialists *regularly* leads to savings as high as 50% — with special taps when required — but often with a simple switch to the right style of standard taps. Why not find out if your tap costs are low as they can be? It costs nothing to consult the HY-PRO specialists.



from 100 to 10,000 holes per tap...

The standard spiral point tap formerly used for tapping an automobile bumper bracket lasted for 100 holes or less, due to breakage. The cause was misalignment which could not be corrected without prohibitive expense for jigs, and for special controls in preceding operations. HY-PRO specialists designed a no-flute, 3-spiral groove tap with special heat-treatment which boosted production to 10,000 holes per tap — with no change in job conditions. Result . . .

98% SAVINGS in tap cost

from 25 to 10,000 holes per tap...

In a tapping operation on a die cast automobile ornament, the standard 3-flute tap being used broke after an average run of 25 holes. The cause was spalling and binding of the relatively soft alloy around the tap. HY-PRO specialists recommended an oversize 3-flute plug point tap with minor flute modifications. Binding was eliminated, and clean cut threads permitted easier assembly. Production was increased to 10,000 holes per tap. Result . . .

99% SAVINGS in tap cost

ASK FOR STOCK LIST OF SPECIAL TAPS AVAILABLE FOR IMMEDIATE DELIVERY

Why "special" tap development brings you better "standards"

Even though you never need "specials", you benefit by HY-PRO leadership in special tap design. The intensive research and testing involved is all reflected in constant improvement of HY-PRO standard taps. HY-PRO specialists can often point out opportunities for substantial savings, even in tapping operations you've considered satisfactory. For information, write: Dept. C.

The Tap Engineering Specialists

HY-PRO

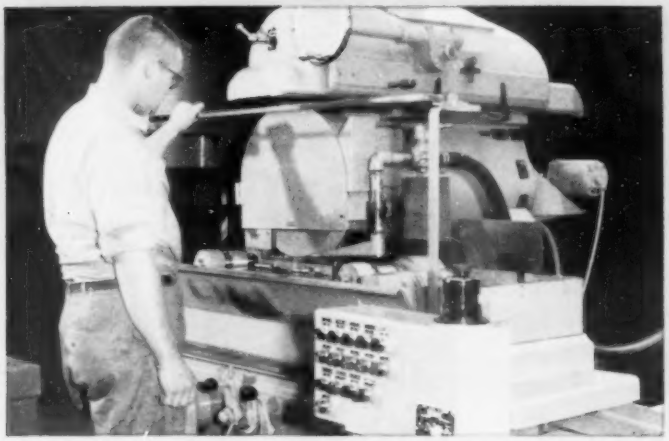
REG. U. S. PAT. OFF.

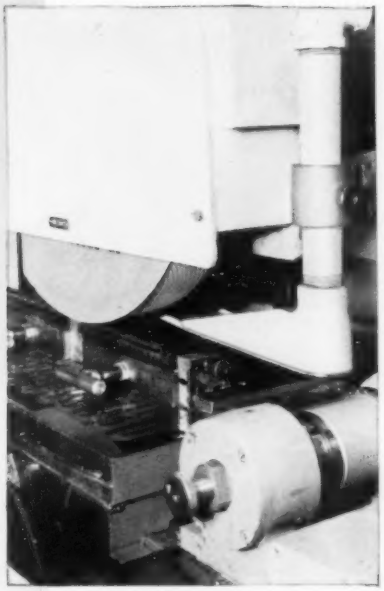
HY-PRO TOOL COMPANY
DIVISION OF CONTINENTAL SCREW CO.
NEW BEDFORD, MASS., U.S.A.

CALL YOUR LOCAL **HY-PRO DISTRIBUTOR** FOR STANDARD TAPS FROM STOCK

Thompson — TRUFORMING CUTS COSTS 66%

. . . DOUBLES PRODUCTION AND IMPROVES PRODUCT AT THE OLIVER CORPORATION





In the production of ledger plates, used in the cutter bar of mowing machines, The Oliver Corp. of Chicago, formerly first milled the teeth, then hardened the plate. The hardening process caused distortion and variance in uniformity which impaired the cutting action of the bar.

On the advice of Thompson engineers, a Type BB Truforming Grinder with a 2½" width grinding wheel was installed to process these ledger plates as a finished grinding operation. The plates are now heat treated first and the teeth are then formed by grinding.

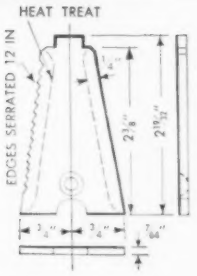
The installation of the Thompson Truforming Grinder has accomplished the following results:

1. **Cut total production costs from $3.18 to $1.06 per 100 pieces.**
2. **Increased the production rate from 1600 to over 3600 pieces per 8-hour shift.**
3. **Provided constant uniformity in the workpieces.**
4. **Eliminated the full-time service of one man.***
5. **A pair of $160.00 milling cutters formerly produced 20,000 pieces. A $60.00 grinding wheel now produces well over 40,000 pieces.**

The leadership of Thompson Truforming Grinders results from 25 years of research and development work in crush form grinding. Today these machines are opening up hundreds of practical, time-saving, profit-improving and cost-cutting applications for industry.

Thompson's engineering experience is available to you without obligation. Write for Catalog T558.

**Automatic machine cycle allows operator time to countersink hole in plate—an operation formerly requiring one man's full time.*



LEDGER PLATE
High Carbon Manganese Steel
Rockwell C52-58

"Keep Thompson in mind for that daily grind"

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

Thompson SURFACE GRINDERS

Self-locking microsize UNBRAKO socket cap and set screws are available in sizes #0 through #3, in heat treated alloy steel and 18-8 stainless steel, at your authorized industrial distributor. He also carries a complete stock of other self-locking UNBRAKO socket screw products.

Make Your Small Assemblies More Reliable with Self-Locking Microsize UNBRAKO Socket Screws

hiRf
High Reliability factor

At SPS we apply a dynamic standard of quality—continually refined—so that our fasteners will always have the high reliability factor required by today's faster speeds, higher temperatures, and greater dynamic stresses. By using SPS fasteners in your assemblies, you increase overall reliability—the certainty of predictable performance under actual service conditions.

For more information on the full meaning of reliability, write for a copy of the new SPS booklet "High Reliability."

Self-locking microsize UNBRAKO socket screws help solve the problem of keeping fasteners tight in small assemblies. These miniature UNBRAKO socket cap and set screws with the Nylok* self-locking feature will not work loose under impact, shock or vibration.

Microsize UNBRAKO socket screws with Nylok simplify fastening of small assemblies where vibration would otherwise require lockwashers, wiring, adhesives or other special means of securing tiny screws. Microsize UNBRAKOs with Nylok require no separate locking elements. They improve design, speed up assembly operations, cut production costs, simplify inventory. They increase reliability by eliminating auxiliary locking devices that sometimes fail in service by loosening.

An UNBRAKO with Nylok is a single, self-locking unit. The permanently installed, resilient nylon pellet—serviceable from —70 to +250°F—forces mating threads tightly together, locks the screw securely, seated or not, wherever wrenching stops. And it can be removed and reused without affecting the reliability of its locking action.

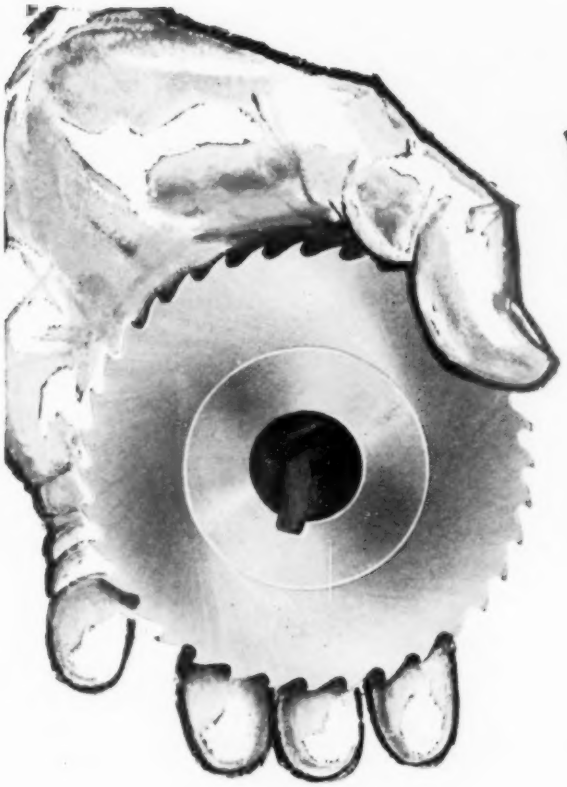
Your local SPS distributor stocks microsize UNBRAKO socket cap and set screws in standard sizes #0 through #3. See him for more information or write for Bulletin 2374. STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

We also manufacture precision titanium fasteners / write for free booklet

SPS **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co. • National Machine Products Co. • Nutt-Shel Co. • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.



no job too large . . .

or too small

M&M's complete line handles them all

REGARDLESS of the type or size of circular saw you require, there's a Motch & Merryweather blade to do the job . . . *better and faster.*

M&M's specially-developed Triple Chip tooth design distributes cutting strain, permits heavier feeds at higher speeds, greatly prolongs the life of each blade.

Your local M&M dealer stocks the complete line of Motch & Merryweather cut-off, slitting and slotting saws. In addition, he is always ready—with the help of M&M's Engineering Department—to assist you in solving unusually difficult sawing problems. Call him today.

FREE—*Send today for your copy of M&M's Circular Sawing Handbook, a pocket-sized guide to sawing operations.*

Q *Quality*
S *Service*
A *Availability*

MOTCH AND MERRYWEATHER

Cutting Tool Manufacturing Division
Cleveland 17, Ohio

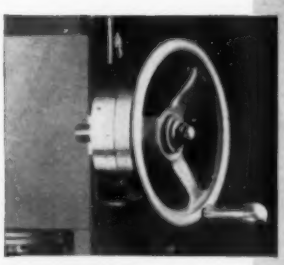
FOOTBURT

Accurate grinding *for small parts*

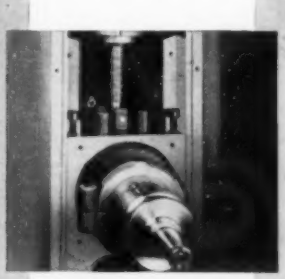
The Hammond No. 2, 6" x 18", Surface Grinder is a precision tool room machine for use on the most accurate gauge and tool work. The standard spindle is direct motor driven and is mounted on precision preloaded ball bearing. Total vertical adjustment is 10¾". In and out movement of table is 6½" with a longitudinal travel of 18".

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

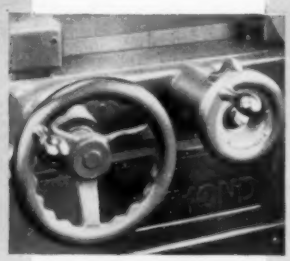
Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.



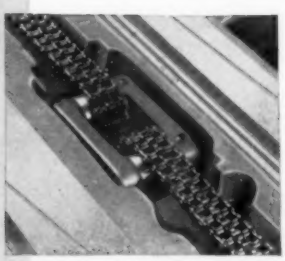
Accurate Spindle Adjustment — Standard vertical adjustment of spindle through handwheel is .0005". With Vernier attachment, spindle can be raised accurately to .00005".



Solidly Supported Spindle Carrier—Spindle carrier is moved vertically on double dovetail ways with adjustable tapered gibs.



Convenient Hand Control — Handy wheels for cross travel, accurately gauged to thousandths, and quick acting longitudinal travel.



Smooth Roller Chain Table Drive—Remarkably smooth finish on work, without chatter marks frequently found when table is moved by conventional means through rack and pinion.

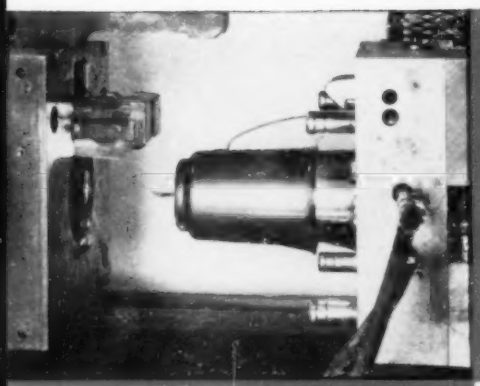
FOOTBURT

Write for Circular #13A.

SURFACE GRINDING

names that mean

"*First Quality Guaranteed*"



DIE STEELS

for
plastic molds
and die casting dies

MC The Mold and Cavity die steel made with particular care to permit blemish-free, highly finished surfaces. Furnished heat treated to 300 Brinell or annealed. Very deep hardening—uniform throughout large sections. Very low movement when oil quenched. For lower finishing costs and longer die life, use MC!

Speed-Cut Free-machining at 300 Brinell. Choose Speed-Cut for economy in producing backing plates, cavity plates, spacer blocks and other plastic die parts. And when you must avoid *all* movement, machine Speed-Cut after hardening—with ease!

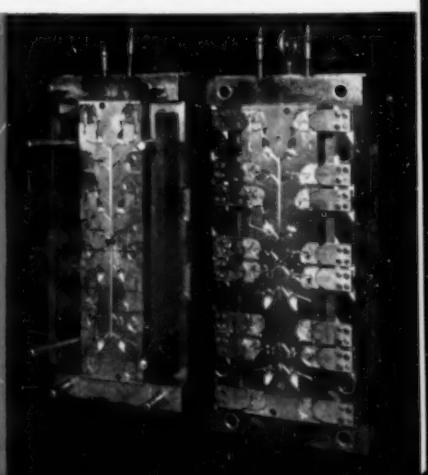
Hotform The original 5% chromium, most widely-used die casting die steel. Will withstand extremes of service conditions—tough, strong, highly resistant to thermal shock.

Write for detailed Data Sheets

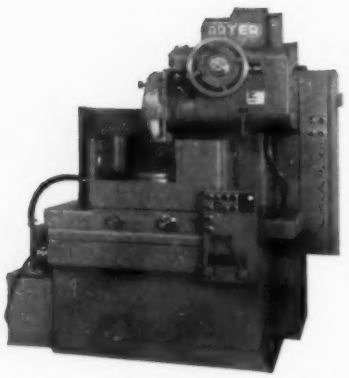
Vanadium-Alloys Steel Company

LATROBE, PENNSYLVANIA

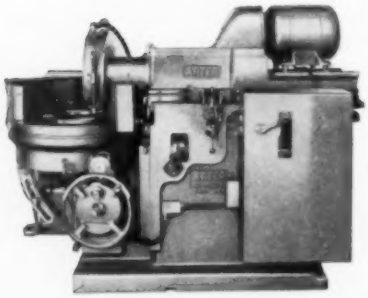
SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni • EUROPEAN ASSOCIATES: Societe Commentryenne Des Aciers Fins Vanadium-Alloys (France) Nazionale Cogne Societa Italiana (Italy)



Announcing the SUNDSTRAND-ARTER Grinder Division



MODEL E HYDRAULIC vertical column rotary surface grinder has reciprocating table and rotating magnetic chuck with 12" and 16" capacities.



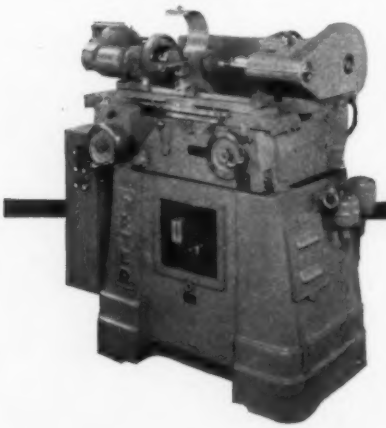
ROTARY SURFACE GRINDER, Model B, is available in four chuck sizes: 20", 24", 30", and 40". Hydraulic motor provides stepless variable speeds to tiltable work table.

Newest additions to the growing line of Sundstrand machine tools are rotary surface grinders, cylindrical grinders, and Jigmatic electronic tape-controlled positioning table — all products of the Sundstrand-Arter Grinding Division. These products — already enjoying an industry-wide reputation for quality and precision — now have the additional backing of Sundstrand facilities and resources.

The same awareness of industry's production needs, interpretation by skilled machine designers, and adherence to the highest standards of manufacturing accuracy that have always distinguished Sundstrand machine tools will be applied to products of the Sundstrand-Arter Grinding Division.

On these pages are shown four examples of Sundstrand-Arter equipment, as well as representative types of milling, turning, broaching, and special machines built by Sundstrand.

Not shown, but equally important to you, is Sundstrand "Engineered Production" — the application of years of design and manufacturing engineering skill to your specific needs. It's another plus you get from Sundstrand to assure maximum machine productivity at minimum cost per piece.



DUAL-PURPOSE internal-external cylindrical grinder uses interchangeable wheelheads to handle both types of jobs in toolrooms on moderate production runs.

JIGMATIC ELECTRONIC tape-controlled positioning table with working capacity of 20" x 30", cuts setup time and eliminates costly jigs and fixtures.

SUNDSTRAND MACHINE TOOL CO.

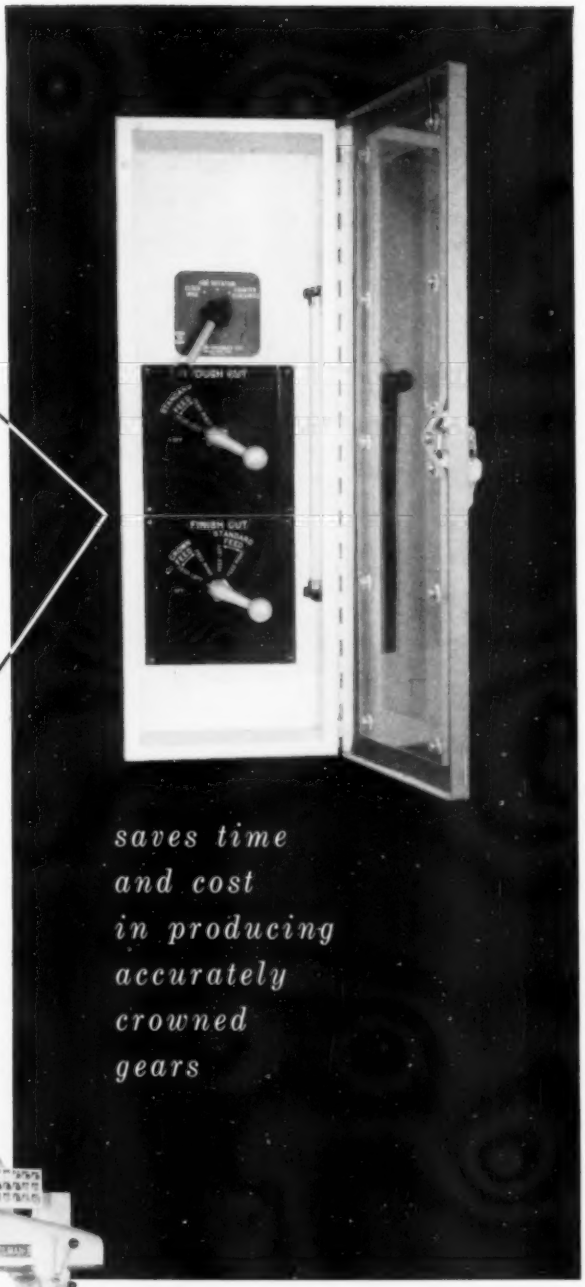
2540 ELEVENTH STREET • ROCKFORD, ILLINOIS

SUNDSTRAND

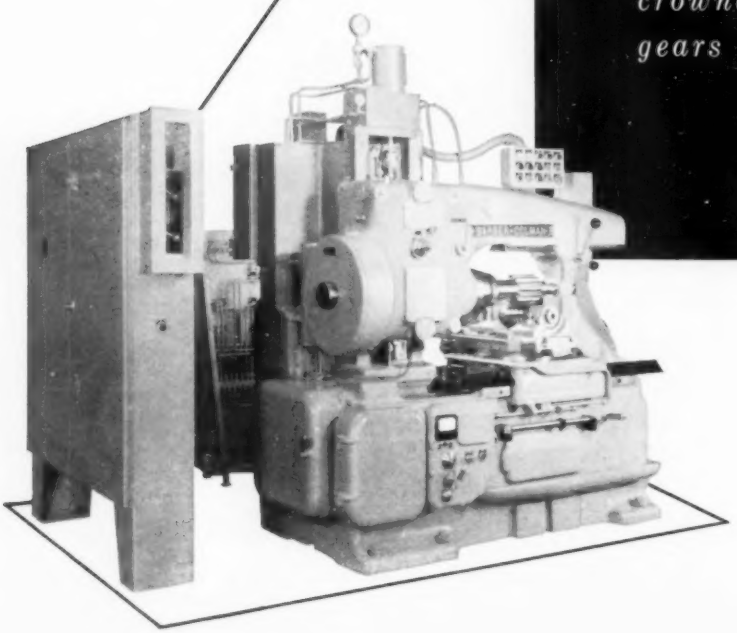
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-25

crown hobbing

with automatic cycle selection



saves time and cost in producing accurately crowned gears



Fairfield Manufacturing Company, LaFayette, Indiana, is crown-hobbing coarse pitch pinions on this special Barber-Colman No. 14-15 Hobbing Machine. Crown-hobbing is a new method for generating crowned gear teeth. Whether shaving is required after crown-hobbing depends solely upon the finish required. If the hobbed finish is satisfactory, shaving can be eliminated. If shaving is required to produce the desired finish, crown-hobbing allows uniform stock removal by the shaving cutter, resulting in reduced production time and increased shaving cutter life.

This machine, especially designed and built for crown-hobbing, may also be used for standard gear hobbing. A choice of automatic cycles is available through settings on the control panel, including hobbing at constant depth and finish crown-hobbing, rough and finish hobbing without a crown, or single cut hobbing with or without a crown, feeding either left or right with climb or conventional cutting.

On the job shown here, Fairfield Manufacturing Company is crown-hobbing 3 D.P. pinions, 14T, 20° P.A., with 5½" face and .008" change in tooth thickness. The automatic cycle includes rough hobbing at constant depth and finish crown-hobbing. In cycling, the machine completes the conventional roughing cut, work slide raises, hob returns to starting position, and work slide lowers to finished depth against the crowning cam. The gear is crown-hobbed at a constantly changing depth, as controlled by the crowning cam, work slide raises, hob returns to starting position, and cycle stops for reloading. Cycle pattern and type of feed are selected by levers on the control panel as shown.

The machine may be designed to suit special job requirements, either as a single-purpose machine, or with the universal feature, as in this case, for both crown and standard gear hobbing. A cam and change gear mechanism for crown-hobbing is provided in the design of the machine for raising and lowering the work slide during the cycle to produce a change in tooth thickness. The work slide is held against the rotary cam by hydraulic pressure in addition to its own weight. Change gears are provided in the cam drive so that different amounts of change in tooth thickness can be produced with the same cam. Different cams can be designed when a different tooth crown configuration is required.

Crown-hobbing also makes it possible to hold a change in tooth thickness within the desired limits, and the tooth bearing can be located at the most desirable point consistent with job conditions.

We welcome your inquiries on crown-hobbing and suggest you send us drawings of your crowned-gears. Our engineers will analyze the job conditions and make recommendations for crown-hobbing. If analysis shows a practical application for crown-hobbing, we shall be glad to cut samples in our laboratory for your approval.

BARBER-COLMAN COMPANY

788 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

THE GAGE THAT REMEMBERS

Use a Pipe Machinery "CORRELCHEK" for faster, more accurate, and complete inspection of pipe threads (ANPT, NPTF, NPT and NGT)

Simple to operate:—

Set the instrument with Master Gages.

Check product to the proper tolerances indicated by color zones on the dial.

Torque controlled to prevent over exertion of pressure by inspectors.

Eliminate discussions and arguments.

Write today for full details.

PATENT NO. 2,833,053

THE PIPE MACHINERY COMPANY

29100 Lakeland Blvd. • Wickliffe, Ohio

Greater Cleveland

COOPERATION...
THE STORY BEHIND THE GREENLEE MACHINE

Production difficulties with hydraulic steering gear housings sparked a bold, new idea . . . an automatic transfer machine capable of performing 114 machining operations to close tolerances on rough castings, at the rate of more than 200 pieces per hour. These production problems were:

1. Maintenance and expense.
2. Locating on a rough casting.
3. Marring finished surfaces.
4. High percentage of scrap.

Any new production method must solve these problems and show savings to justify the investment in new machinery.

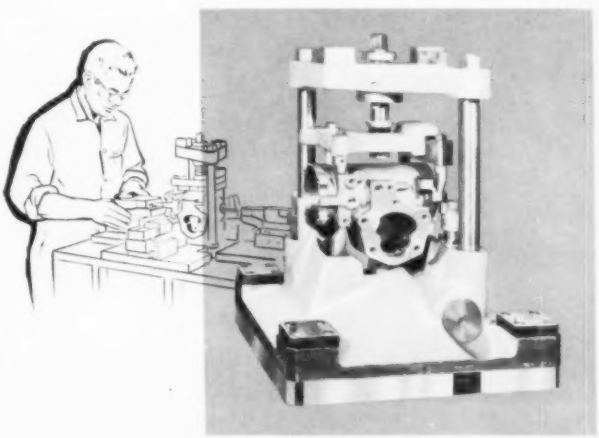
These problems were discussed during a meeting with the customer. Greenlee sales engineers made a careful, complete study of the problems and prepared a machine proposal sketch, a wooden model of the work holding pallet, and a firm price for the recommended equipment.

Meetings were held at Rockford and at the customer's plant where management, production, tooling and inspection people . . . engineers from both companies, who were familiar with the job, participated. In addition, arrangements were made for the customer to visit other plants where Greenlee machines were in operation. These visits enabled them to see operations similar to the ones required on the proposed machine.

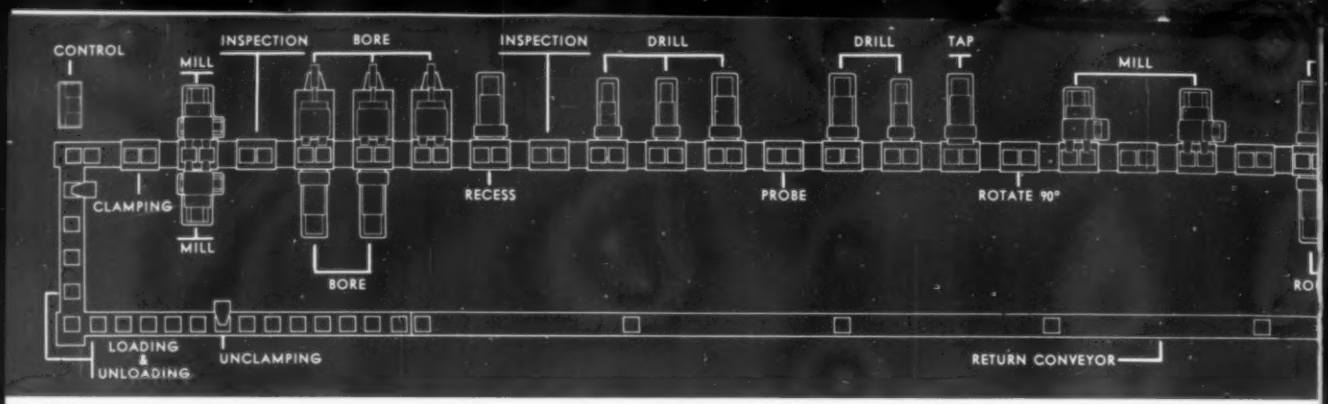
Operations studied included the handling of chips and coolant, foundation design, gauging on the machine, tool grinding, use of pre-set tools and tool control boards, and accuracy of Greenlee machines after years of continuous use. Specific machining operations were also studied on transfer machines similar to the one being planned.

After all of these factors had been carefully analyzed by the customer, the Greenlee proposal was approved.

The machine was designed to handle the rough casting in a work holding fixture or pallet. Once located and clamped in the pallet, the housing is completely machined before being released. All machining operations are performed in proper relation to each other, and any tendency to mar finished surfaces is eliminated.



GREENLEE BROS. & CO. ROCKFORD, ILLINOIS, U.S.A.



A walking-beam type of transfer mechanism was used to carry the pallet from station to station. Thus the clamping pads and locating bushings of the pallet would be kept clean and free from burrs or chips. These critical surfaces are never touched by the transfer bars or anything else except the mating clamp pads and locating pins which enter the bushing at the work station. The castings are machined two at a time until they reach the last machining section where they are finish bored four at a time.

The pallets then enter the return conveyor one at a time where a number of de-burring operations are performed. Finally they transfer through a two stage flushing and blow-off unit where pallets and castings are cleaned before their rapid-return to the head of the machine for automatic unclamping.

The machine itself is of the usual Greenlee Rearrangeable Unit design to facilitate shipping and installation, and to take care of possible future engineering changes and improvements in design of the part.

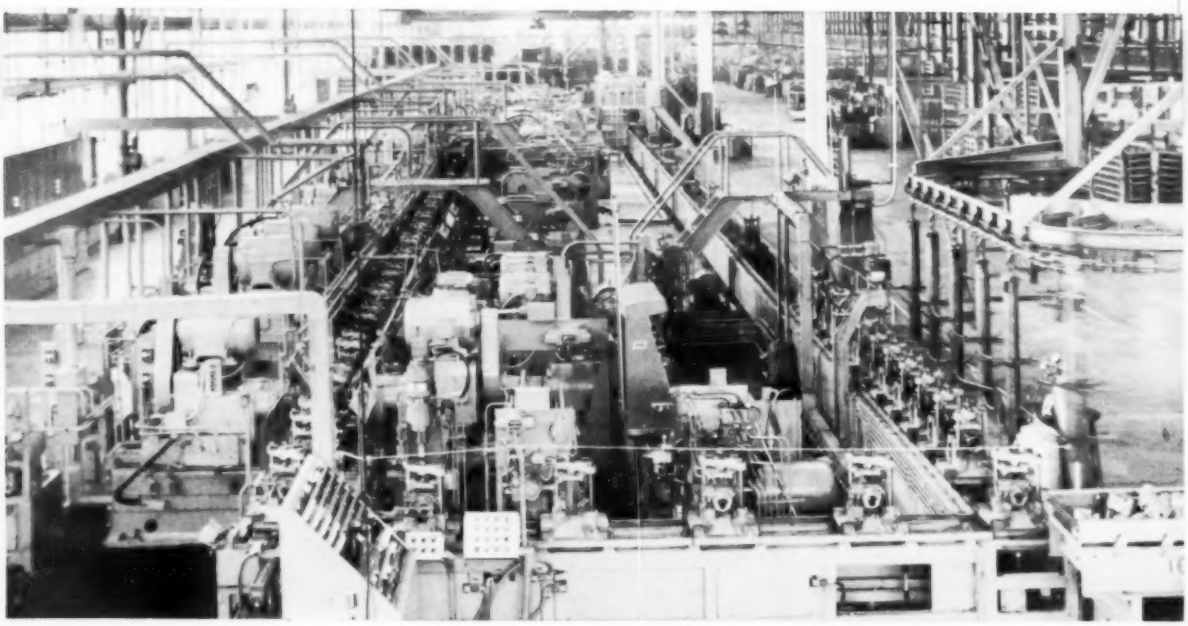
Thus, proper design of the machine and the closely coordinated details of tooling and installation *SOLVED THE FIRST PRODUCTION PROBLEM.* Use of pallets for locating and holding the castings *SOLVED THE LAST THREE PRODUCTION PROBLEMS.*

Throughout the design and building period, details were checked carefully with the customer's tool engineers, production people, inspectors, maintenance and plant engineers. During the final stages of assembly and testing in the Greenlee plant at Rockford, these people were thoroughly schooled in technical details of the machine.

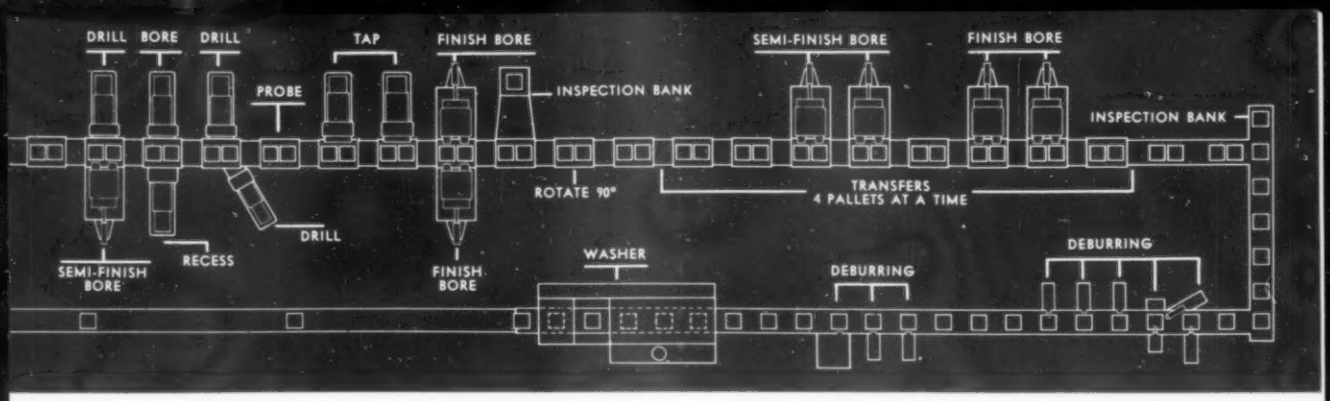
Following successful test runs, the machine was dismantled and shipped. The first of 21 truck loads left the Greenlee plant on a Tuesday morning — the last one Friday. The next Monday evening . . . six days after the first shipment . . . the machine was automatically cycled in the customer's plant and put into production. Cooperation between experienced Greenlee supervisory personnel and customer's men made this record possible.

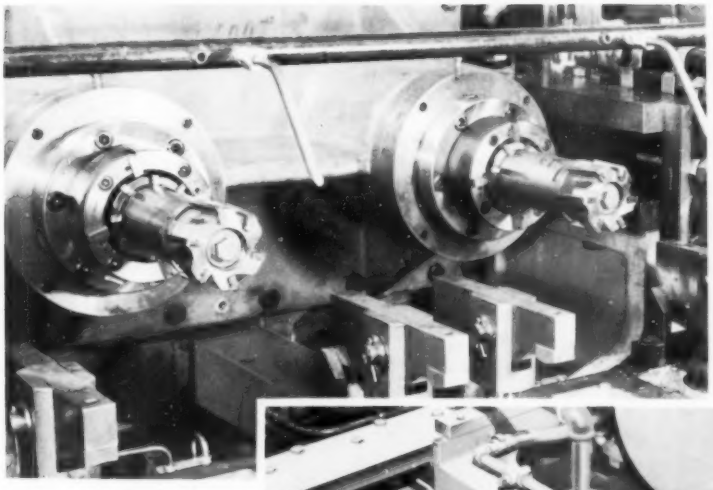
This is the story behind the machine . . . a story that began with a production problem . . . a problem that has been successfully solved by the intelligent cooperation of the men who represent the machine builder and the machine user . . . cooperation that made it possible to produce parts to close tolerances at the required production rate with a minimum of maintenance and expense.

GREENLEE



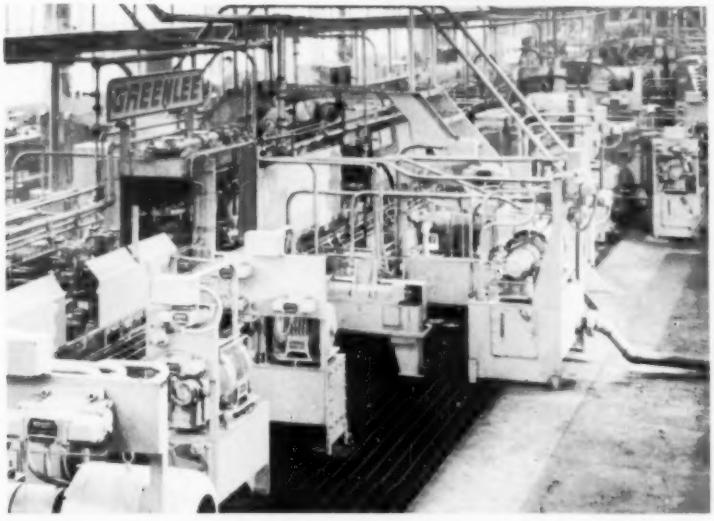
The rough casting is machined wet on this 128 station, 225 ft. Greenlee palletized transfer machine. The machine is completely automatic with all operations synchronized. One operator handles the loading operation and controls all functions of the machine. The electrical control panel and system of lights locates immediately any trouble throughout the system. All hydraulic units conform to the J.I.C. standards for easy maintenance. An automatic lubricating system provides the correct amount of lubrication to the ways and moving parts.





BORING ACCURACY ASSURED: Hydraulic steering gear housings call for a high degree of accuracy in the cylinder bore and pitman shaft hole. To maintain the accuracy, to increase tool life, and make pre-set tooling possible it was decided to use multiple blade boring tools.

Greenlee boring slides of massive construction were used to properly support the boring tools. Tool life, accuracy and surface finish on the $3\frac{1}{2}$ dia. x 7″ deep cylinder bore and the important pitman shaft hole have been far better than all estimates.



AUTOMATION: Both the machine and the conveyor are entirely automatic and completely interlocked for safety.

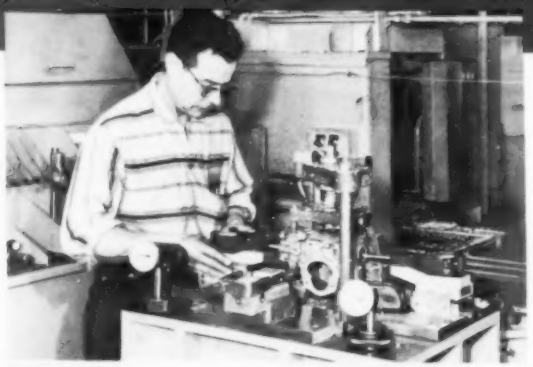
Failure of any unit or sequence will immediately prevent the machine from cycling. An emergency cord on each side of the machine runs its full length. When this cord is pulled, all heads withdraw 1/16″ and stop, preventing the possibility of tool damage.

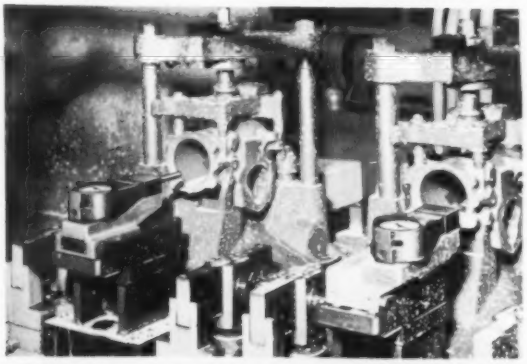
The machine operator removes finished parts and places rough castings in the unclamped pallet. Locating of the part in the pallet, clamping and unclamping is automatic.

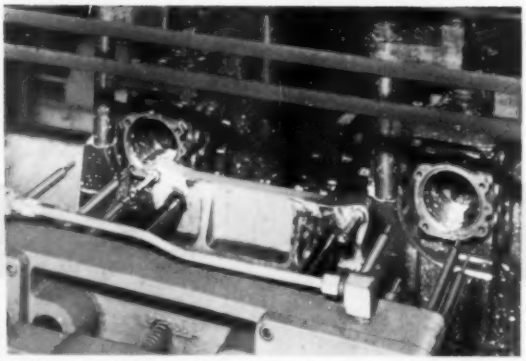
INSTALLATION: Machine is placed on a reinforced concrete foundation designed to maintain cleanliness and avoid a wet deck. It has a built-in conveyor which carries the chips and coolant to an automatic reclaiming unit. The filtered coolant is returned to the system and the dry chips are blown outside into a railroad gondola. More than 700 GPM of coolant and a quarter ton of chips are processed hourly.

GREENLEE BROS. & CO.

ROCKFORD, ILLINOIS, U.S.A.







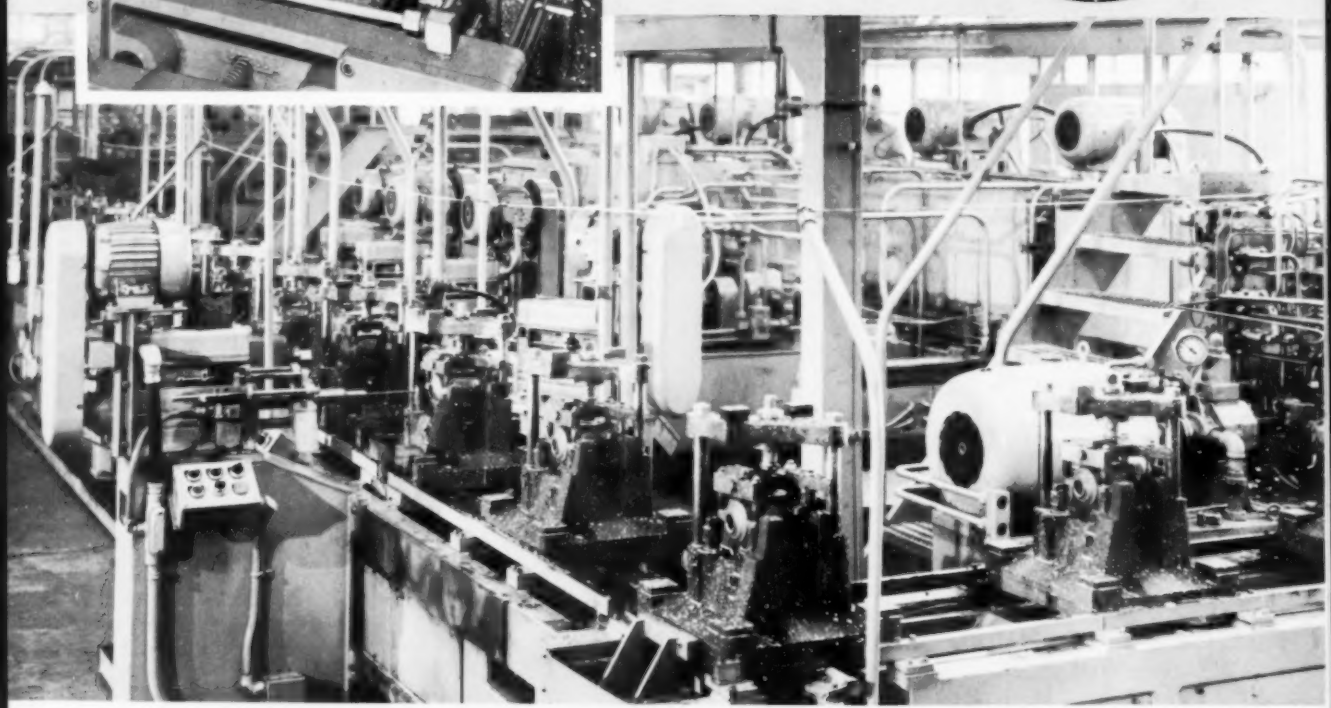
INSPECTION: Idle stations provided at intervals the length of the machine are used for both gauging and visual inspection.

In addition, at Stations 31 and 44 provision was made for the removal of pallets onto an inspection bank where more detailed inspection operations can be performed at regular intervals making certain of rigid quality control. During inspections, the machine continues to produce at the normal rate.

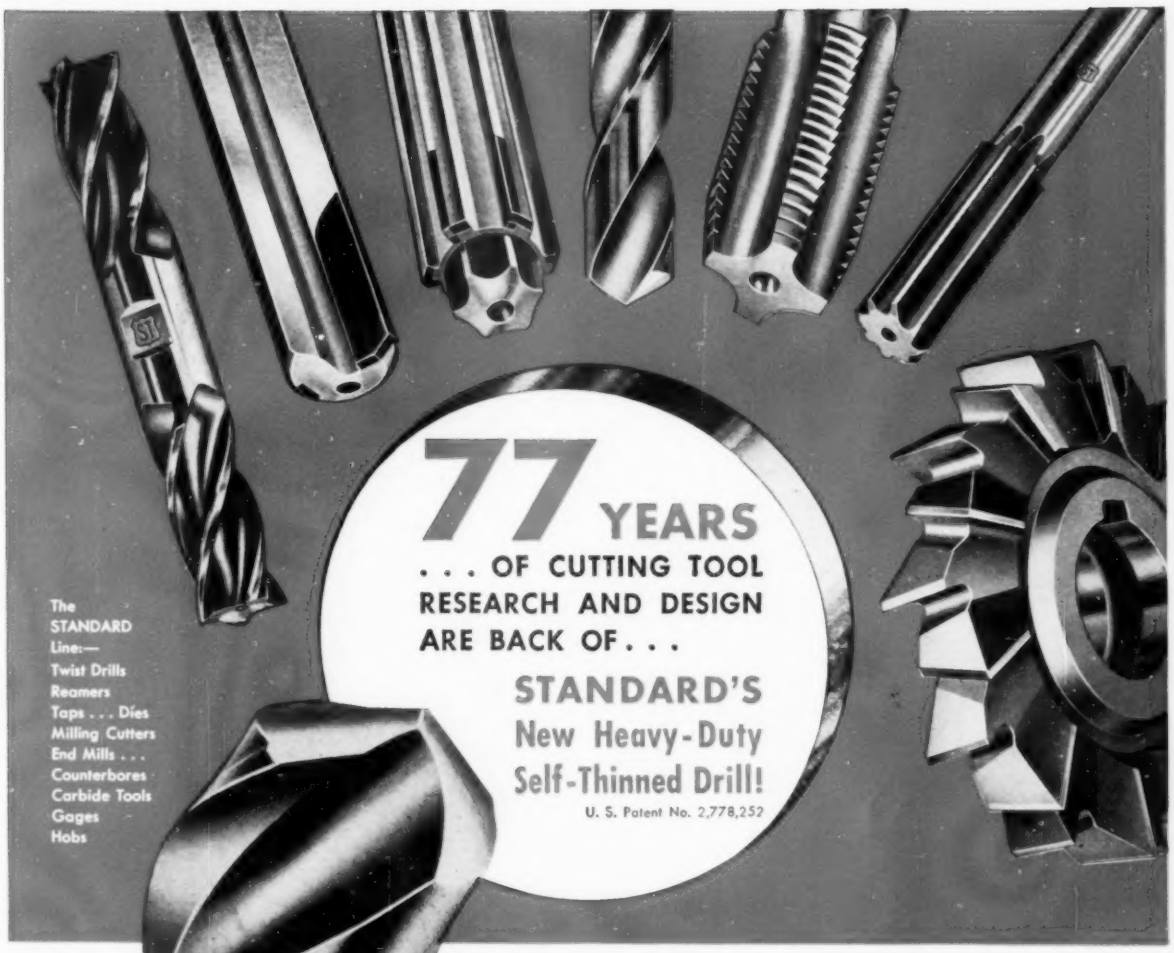
DEBURRING UNIT: Hydraulic devices must be absolutely free from all foreign matter. Deburring is an important and precise operation. Twelve stations were provided in the return conveyor where the pallet is located and clamped providing space for several automatic, and one hand burring operation. These include the deburring of drilled holes, corner breaking on cylinder bores and an emery cloth operation on finished faces. Deburring units are interlocked with the machine and conveyor.

FLEXIBILITY: Flexibility of operation is designed into the machine. Re-arrangeable unit construction and idle stations fitted with locating and clamping fixtures will make it possible to adapt the machine to a radically different housing at a fraction of the original cost.

PRODUCTION MACHINERY
GREENLEE



Printed in U.S.A.



77 YEARS

. . . OF CUTTING TOOL RESEARCH AND DESIGN ARE BACK OF . . .

STANDARD'S New Heavy-Duty Self-Thinned Drill!

U. S. Patent No. 2,778,252

The STANDARD Line:—
Twist Drills
Reamers
Taps . . . Dies
Milling Cutters
End Mills . . .
Counterbores
Carbide Tools
Gages
Hobs

WEB THINNING is required each time a conventional type heavy-duty drill is resharpened.

DISADVANTAGES:
- Increased grinding costs.
- Problem of keeping point "On Center."

STANDARD'S New, Self-Thinned, Heavy-Duty Drill is designed with the *thinning operation* "built-in" the flute contours.

ADVANTAGES:
- Elimination of costly "web thinning" for the normal useable life of the drill.
- Accurate cutting tool assured by efficient "point-on-center" control.

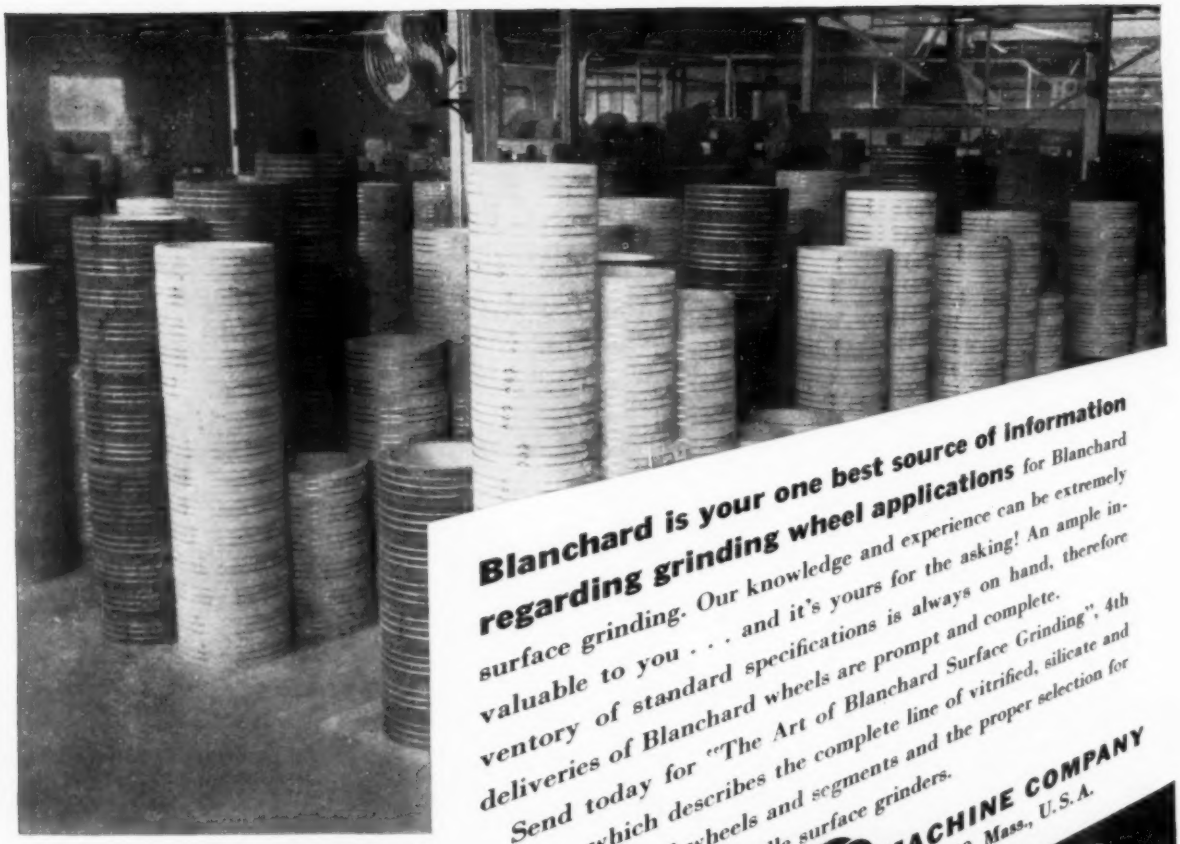
The STANDARD Distributor in your area stocks a complete line of rotary metal cutting tools.

Quality Tools Since 1881

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

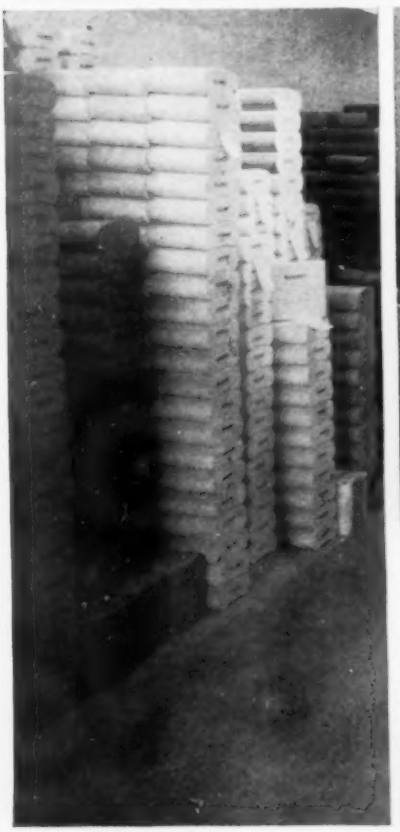
BRANCH OFFICES IN: NEW YORK · DETROIT · CHICAGO · DALLAS · LOS ANGELES · SAN FRANCISCO

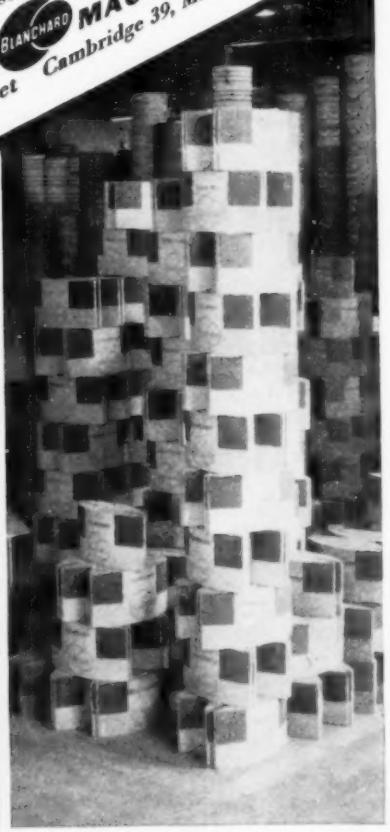


Blanchard is your one best source of information regarding grinding wheel applications for Blanchard surface grinding. Our knowledge and experience can be extremely valuable to you . . . and it's yours for the asking! An ample inventory of standard specifications is always on hand, therefore deliveries of Blanchard wheels are prompt and complete.

Send today for "The Art of Blanchard Surface Grinding", 4th edition, which describes the complete line of vitrified, silicate and resinoid bonded wheels and segments and the proper selection for Blanchard vertical spindle surface grinders.

THE BLANCHARD MACHINE COMPANY
64 State Street Cambridge 39, Mass., U.S.A.





Your tooling resin formulator can help you

In an ever-widening range of production applications, tools and dies made with Epon resin-based formulations are giving outstanding service . . . and providing considerable savings compared to the cost of conventional tooling.

If you are concerned about the high cost of conventional tooling—your tooling resin formulator will show you how to get the most out of durable, impact-resistant Epon resin tools. His skill and knowledge, combined with Shell Chemical's years of experience and research, can mean more profitable production for *you*.

High-temperature tooling. Both metal and plastic forming tools, capable of operating at temperatures between 400°F. and 500°F., can be made with Epon 1310.

Long-lasting metal forming tools. Test results show that a casting of an Epon resin formulation mounted in a crank press and subjected to repeated blows had no permanent deformation after 28,000 cycles.

Excellent tolerances. Little machining and handwork are required to finish Epon resin tools, because the material can be fabricated to very close tolerances.

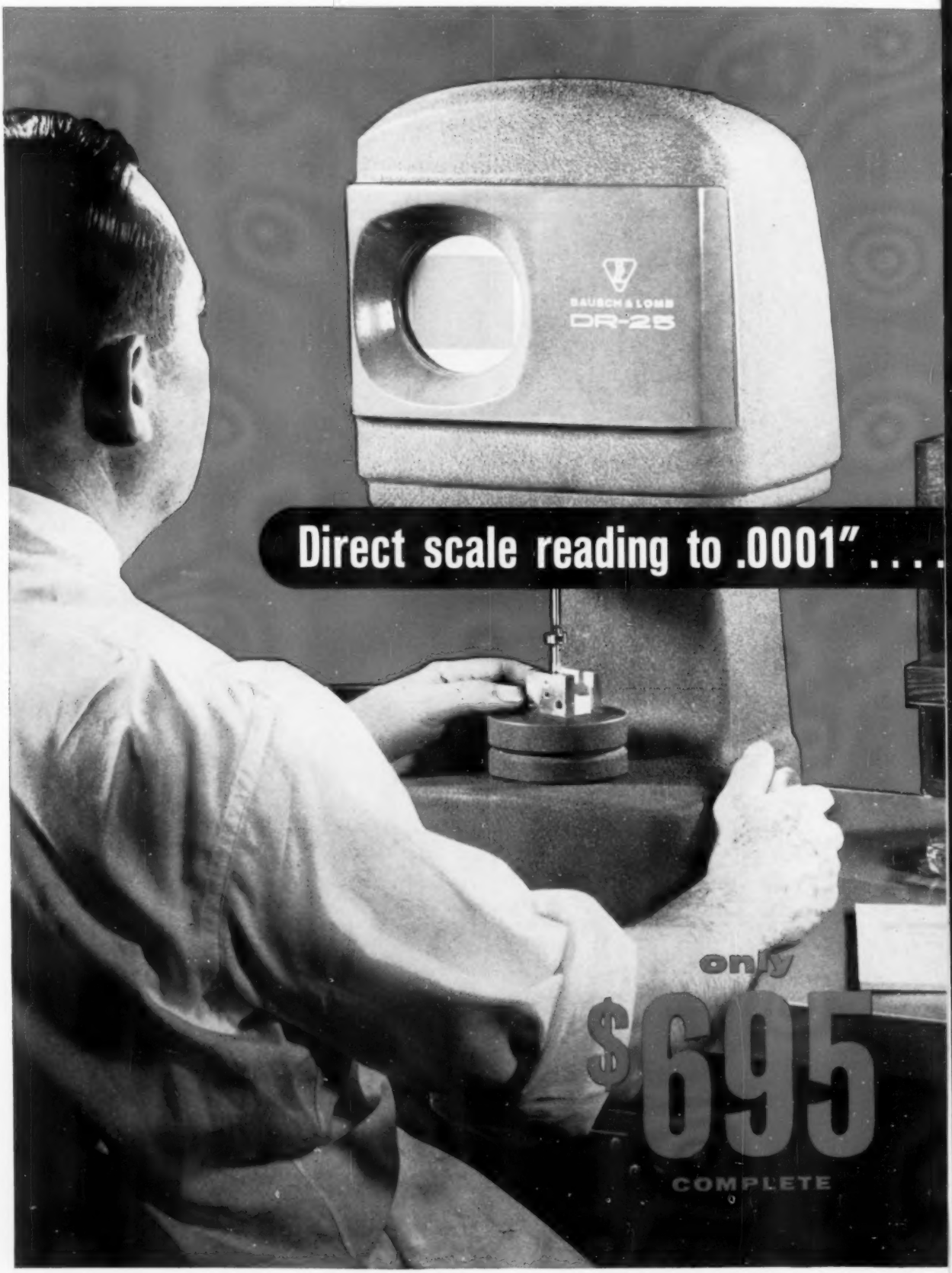
Outstanding strength. Tools with thin cross sections can be laminated with layers of glass cloth and Epon resin to achieve high flexural strength, and dimensional stability.

Can Epon resin help you with your tooling? Find out now by writing your tooling resin formulator. For a list of tooling resin formulators and further information on Epon resin, write to Shell Chemical.

SHELL CHEMICAL CORPORATION
CHEMICAL SALES DIVISION

Atlanta • Boston • Chicago • Cleveland • Detroit • Houston • Los Angeles • Newark • New York • San Francisco • St. Louis
IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited, Montreal • Toronto • Vancouver

SHELL

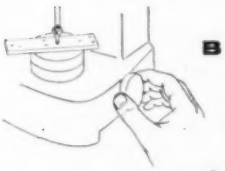

BAUSCH & LOMB
DR-25
Direct scale reading to .0001" . . . .
only
$695
COMPLETE

New! BAUSCH & LOMB DR-25 OPTICAL GAGE

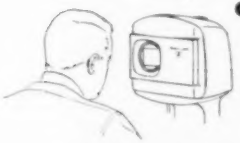
. . . . . 0″ to 3″ range . . . accurate to .000025″!

FAST, EASY AS A-B-C!

A Just set part to be measured on anvil . . . no masters or set gages needed.



B Turn knob to lower spindle . . . it will stop automatically on contact, with constant spindle pressure.



C See precise measurement at a glance . . . direct-reading scale is illuminated, magnified. No eyestrain, no conversion, no guesswork.

DEPENDABLE ACCURACY!

Direct readings to .0001″; keeps production to quality specification. Master scale ruled on world-famous B&L Grating Ruling Engine. Every DR-25 Optical Gage is accurate to 0.000025″.

PRACTICAL, ALL-PURPOSE!

Direct scale measurement of depth, thickness, height, diameter, taper, angularity of surfaces, runout. Large work table makes it easy to adapt special fixtures. Deep (4¼″) throat, open sides and large staging area accommodate widest variety of work.

ON-THE-JOB DEMONSTRATION!
NO OBLIGATION...
JUST MAIL COUPON TODAY!

BAUSCH & LOMB
SINCE B&L 1853

Distributed in the U.S.A. through the DoALL Co.

BAUSCH & LOMB OPTICAL CO.
76332 St. Paul St., Rochester 2, N. Y.

☐ I'd like a free on-the-job demonstration of the new B&L DR-25 Optical Gage, with no obligation on my part.

☐ Please send Catalog D-285.

NAME .....

COMPANY ..... TITLE .....

ADDRESS .....

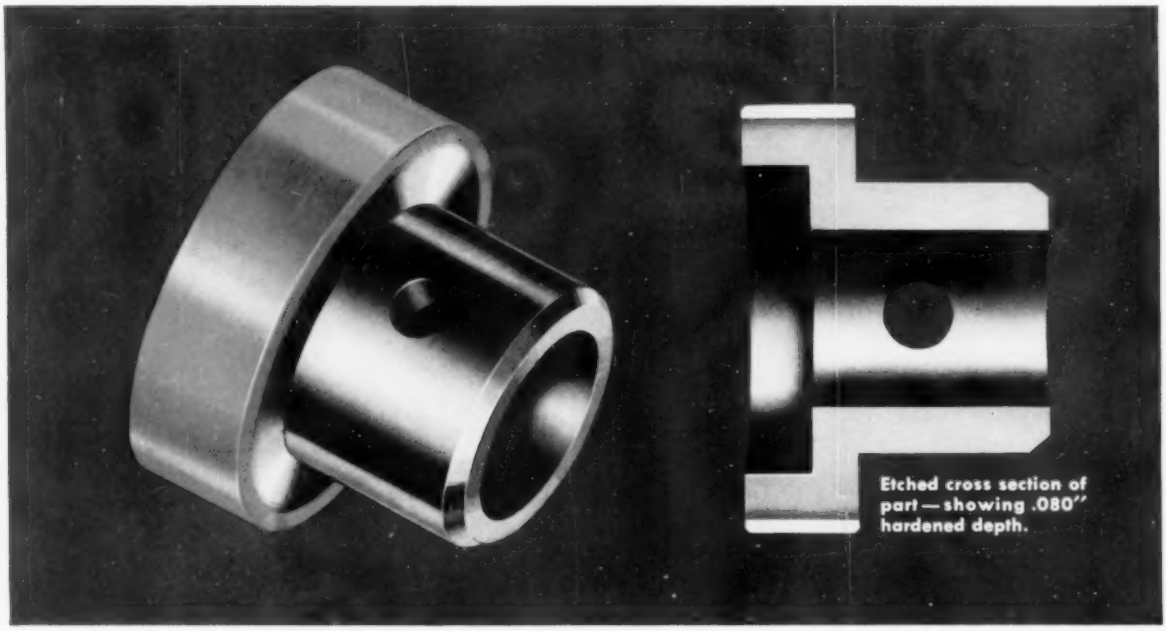
CITY ..... ZONE ..... STATE .....

Costs Cut 94%

with

TOCCO* *Induction Heating*

A cost reduction of 94% resulted when heat-treatment of this Corn Harvester part was changed from carburizing to TOCCO-hardening. Look at the unit cost breakdown:



CARBURIZING		TOCCO-*Hardening*	
Degrease	$0.0020	eliminated	
Carburize	0.0200	eliminated	
1st quench	0.0150	TOCCO, heat and quench	$0.0060
2nd quench	0.0150	eliminated	
Draw	0.0050	eliminated (self-draw)	
Shotblast	0.0035	eliminated	
Internal Grind	0.0243	eliminated	
External Grind	0.0166	eliminated	
	$0.1014		$0.0060

"...Savings of 9½ cents per piece — $4770.00 on each 50,000 piece batch, *plus* an hourly production increase from 120 to 300 pieces per hour, plus improved quality of the product by virtue of the deeper case and stronger core."

Have you investigated TOCCO's cost-savings possibilities for your hardening, brazing, melting or forging operations? Why not write us today or send blueprints of your parts — no obligation, of course.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. G-8, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

Officers

George A. Goodwin
President
Dayton, Ohio

Wayne Ewing
Vice President
Los Angeles, Calif.

H. Dale Long
Vice President
Chicago, Ill.

William Moreland
Vice President
Ashland, Ohio

David A. Schrom
Vice President
York, Pa.

Philip R. Marsilius
Treasurer
Bridgeport, Conn.

Charles M. Smillie
Secretary
Detroit, Mich.

Harry E. Conrad
Executive Secretary
Detroit, Mich.

Allan Ray Putnam
Asst. Executive Secretary
Detroit, Mich.

Board of Directors

G. A. Goodwin *Chairman*
Dayton, Ohio

G. Ben Berlien
Oakland, Calif.

I. H. Buck
Dallas, Texas

H. E. Collins
Houston, Texas

Wayne Ewing
Los Angeles, Calif.

Frank Ford
Atlanta, Ga.

Edmund Hollingsworth
Philadelphia, Pa.

H. Dale Long
Chicago, Ill.

P. R. Marsilius
Bridgeport, Conn.

H. C. McMillen
Bedford, Ind.

Joseph L. Petz
Poughkeepsie, N. Y.

J. X. Ryneska
Lynn, Mass.

L. C. Seager
Salt Lake City, Utah

C. M. Smillie
Detroit, Mich.

W. A. Thomas
Windsor, Ontario

Editorial Committee

Donald E. Zierk *Chairman*
Dundee, Ill.

Harold Sullivan *Vice Chairman*
Minneapolis, Minn.

John C. Hatter *Vice Chairman*
Long Island, N. Y.

Leo Tarasov
Worcester, Mass.

William Moore
Riverside, Ontario

A. R. Jones
Seattle, Wash.

What Price Ideas?

When searching diligently for a needed idea to solve a problem, you probably offer a pretty good price. On the other hand, once started, ideas come "cheaper by the dozen." One hatches another, and another, and when you start trading they multiply faster than you can sometimes use them.

I like that Bob Douglas story which you have probably heard. Bob says: "If you meet a friend and you each have a dollar in your pocket, you can exchange those dollars without any gain, but if you each have an idea and you exchange ideas, you are both richer because you each have two ideas." How true this is can be observed almost daily and ASTE has done its share in bringing this about.

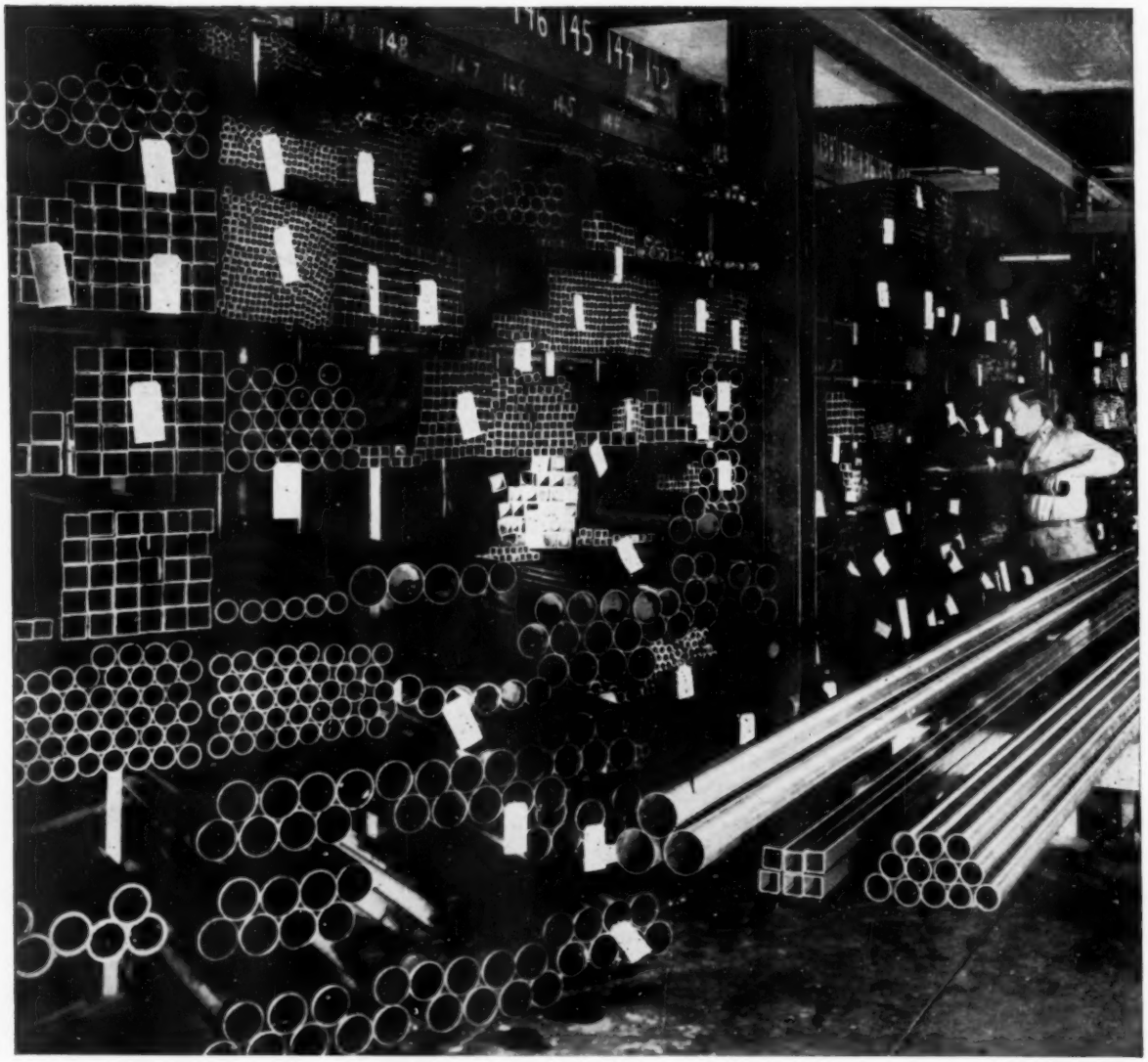
Back in granddad's time if a man had an idea that was worth anything, he usually kept it a secret. Industry was loaded with secret processes and techniques, many of them performed in separate rooms under lock with only limited personnel admitted. In fact, returning from school, I daily passed an iron foundry where my great-uncle was superintendent. I frequently stopped to watch for an hour or more at an open window. One day my uncle saw me and came over to chat. I plied him with probably a half dozen questions before he answered the first. He finally answered one or two but then said, "If I would answer all your questions you'd know as much about this business as I do."

Thank heaven, we don't have much of that attitude today. In fact, if a competitor drops in to observe a new piece of equipment you're likely to roll out the welcome mat and give him a good demonstration. You ask about what he does as a substitute, or perhaps discuss some of his other operations. When he leaves, you are both richer by your exchange of knowledge and ideas. It's done every day.

Such examples of cooperation in a system of competitive free enterprise are an important factor in the national economy, national defense and national improvement in living standards. It's a part of the American way of life. May it always continue as a policy of ASTE and its members.

G. A. Goodwin

PRESIDENT
American Society of Tool Engineers



The type of tubing you need is here

It pays to analyze your tubing requirements with a Ryerson tubing specialist. He is well qualified to help you select the right tubing for your purpose from Ryerson's diversified stocks.

The Ryerson specialist knows tubing—knows what will work best and why. In many cases, he can recommend a type that will do a better job for you—perhaps a newer type that will save you money, either in first cost or in the cost of using it.

Ryerson carries the nation's largest stocks of steel tubing—all of certified quality—and uses the finest modern equipment to cut to your exact specifications. And Ryerson delivers fast—one tube or a thousand.

The Ryerson tubing specialist is as close as your telephone. Give him a call today.

RYERSON® CERTIFIED QUALITY®

RYERSON STEEL®

Member of the INLAND Steel Family

Tubing in stock: Seamless and welded mechanical tubing; fluid line, pump cylinder and structural tubing; stainless pipe and tubing; PVC pipe and fittings. Also, aluminum tubing in many plants.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK · BOSTON · WALLINGFORD, CONN. · PHILADELPHIA · CHARLOTTE · CINCINNATI · CLEVELAND DETROIT · PITTSBURGH · BUFFALO · INDIANAPOLIS · CHICAGO · MILWAUKEE · ST. LOUIS · LOS ANGELES · SAN FRANCISCO · SPOKANE · SEATTLE

preparing engineers for industry

By Lyman L. Francis*
Associate Professor
Dept. of Mechanical Engineering
State College of Washington
Pullman, Wash.

Complex plant operations have created the need for engineers who combine practical production know-how with comprehensive knowledge of engineering theory. Engineering schools are handicapped in training this type of engineer because of inadequate shop and laboratory facilities.

As ENGINEERING SCIENCES are developed, educators are faced with the problem of finding room for new or expanded courses in already crowded curricula. One solution has been to de-emphasize practical laboratory work. Shop and laboratory courses that teach the application of theoretical knowledge to practical problems have a definite place in preparing students for work in industry.

Courses in machine tool operation, welding and foundry work, to name a few, should be up to date and should present an opportunity for students to gain a thorough knowledge of current industry practices.

The modernization of shop courses has proceeded slowly. One reason has been the tendency of some educators to retain outmoded shop projects. A professor of engineering in a large school has stated that he is in favor of retaining a traditional but outmoded forging shop project because "it is good for the student's soul." This type of thinking is not the rule in engineering education, but enough exceptions exist to make progress difficult.

Another, and more important, reason for the slow modernization of shop courses is the high cost of modern equipment. Availability of surplus equipment from the Federal Government has been a boon to many shops, but much of this equipment is either obsolete or unusable when it is declared surplus. With the rapid advances that are being made in in-

*Senior member ASTE Portland, Ore., chapter.

Educators are faced with the problem of finding room in engineering curricula for new courses.

Laboratory Work in Engineering Schools

Type of Laboratory	Schools Offering Course (percent)	Schools Requiring Course (percent)	Clock Hours per Week (average)
Machine shop	90	90	3.7
Welding	73	67	3.0
Foundry	50	50	3.1
Gaging	28	22	3.5
Forging	10	9	2.4
Tool design	5	2.5	2.0
None	5	—	—

dustrial methods and techniques, most shops are out of date before they are fully equipped.

Present Status of Practical Training: These facts were brought out in the course of a survey of 79 accredited engineering schools. The purpose of the survey was to determine the status of shop courses in engineering school curricula. As shown in the accompanying table, 75 of the 79 schools offer at least one shop laboratory course. Some schools offer all of the courses listed; others offer only one or two.

In all except nine schools, laboratory work is accompanied by a lecture course. At 47 schools, separate lecture courses are offered for each laboratory course; at 23 other schools one lecture course serves all laboratory courses. In the past, most of the lecture courses associated with laboratory courses were primarily designed to give instructions for work to be performed in the laboratory. The present trend is to give more comprehensive treatment in lecture courses.

Students spend more time in machine shop laboratories than is devoted to other laboratory work. The maximum number of clock hours is eight, while the minimum is one hour. The average number of machine shop hours is 3.7 per week. Work in welding, foundry and gaging laboratories, where these courses are offered, also ranges from one to eight hours per week. A maximum of three hours per week and a minimum of one hour per week are offered in forging and tool design laboratories. Many of the schools surveyed indicated that reductions in the time allocated for laboratory work were contemplated; others said that reductions in hours had already taken place.

Machine shop courses are required to obtain a mechanical engineering degree in 70 of the 79 schools. Work in the welding laboratory is required in 53 schools and work in the foundry laboratory in 40 schools. Only 17 schools require gaging laboratory work; seven require forging laboratory

A balanced combination of theory and practical training provides the best engineering education.

training and two require tool design work.

Ten schools offer a degree in production engineering or tool engineering, out of a total of 77 schools surveyed on this question.

Sixty-nine schools answered questions concerning their annual budgets for engineering laboratories. Nineteen schools note that their budgets are increasing; 11 percent report decreasing funds; and 39 are budgeting the same amount each year for shop laboratory courses.

Several of the conclusions that can be drawn from the survey are surprising. For instance, only 16 of the 22 schools offering gaging laboratory work require this course of their mechanical engineering students. It would seem, however, that practical knowledge of gaging should be a necessary and important part of the training of all mechanical engineers.

The failure to offer degrees in production or tool engineering also raises the question of whether or not engineers are being adequately prepared for industry. While it is possible that present mechanical or industrial engineering curricula provide adequate training for graduates who intend to work in industry, the large number of company training programs for new engineers leads to an opposite conclusion.

Those schools that have dropped laboratory courses gave various reasons for doing so. Some schools state that it is impossible to keep laboratories up to date due to rapid technological changes in industry. Others note that the time is needed for more "important" subjects. The problems connected with maintaining laboratories were summarized by one school which said that:

"The cost of machine tools is now so far out of sight that it is almost impossible to maintain an up-to-date machine tool laboratory. As a consequence, we are depending more and more upon the use of films and demonstration work to indicate to our students what can be done. This is not the best way, but it seems to us about the only way we can operate within the limits of funds, of space, of staff, and of student time available." This sums up the predicament of engineering schools.

How Industry Can Help: By and large, engineering schools are doing an excellent job of preparing students for positions in industry. In the future, however, industry will require greater numbers of engineers who have had practical training, particularly in production methods. Not too many years ago, the majority of graduate engineers were not directly concerned with actual production operations. Today, the situation has changed. Machines, tools, jigs and fixtures have become so complicated that a comprehensive engineering education is needed to solve day-to-day production problems. Unfortunately, the fields in which engineers are needed are precisely those in which engineering schools provide minimum training.

Much of this training can be provided in laboratory courses. Supplemental on-the-job training during school vacations is another valuable means of training engineers with production know-how. Students benefit immeasurably from summer employment provided they are used as engineers, and industry will ultimately benefit by acquainting students with the problems they will face as production engineers.

Laboratory equipment is often obsolete but replacement costs are too high for schools to afford.

Industry can also help engineering schools to turn out a better product by making equipment available to school laboratories. Many students have no opportunity to see some types of equipment before they leave engineering school. Jigs, fixtures, dies and special forming tools are among the items that would be of great value in training engineers. Large pieces of surplus equipment are also welcome in most schools if obtainable at a reasonable price.

Many companies have produced films that are helpful in keeping students and instructors in touch with processes and developments that cannot be duplicated in the laboratory. More of this type of assistance would be valuable.

Other companies have developed courses for training their own engineers in specialized fields. Some of the visual aids that are used in these training sessions could, if loaned to engineering schools, be put to good use.

Cooperation between industry and engineering schools will, in the long run, help to insure a supply of engineers who are of real value to industry. These engineers will have a knowledge of practical manufacturing, as well as theoretical knowledge of the basic engineering sciences. This combination will pay off in greater engineering productivity.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Facing Contours

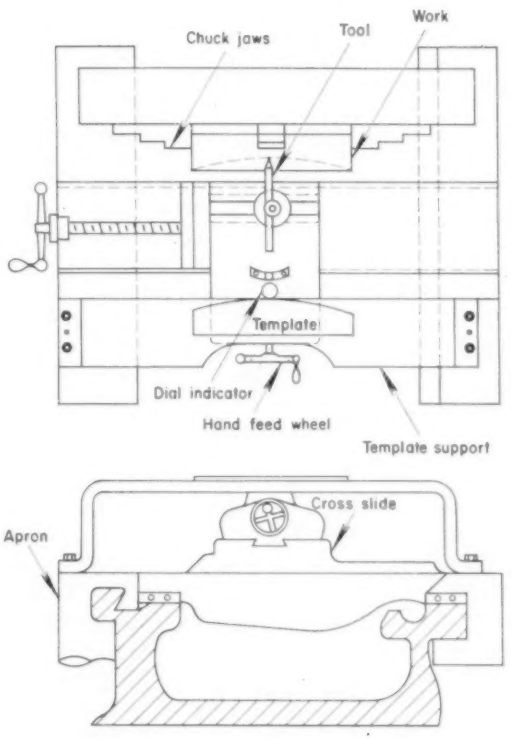
Concave or convex contours can be accurately machined on an engine lathe, using a full-size template. In the setup illustrated, which was devised for facing a small quantity of molds, the lathe compound is swung 90 deg with the tool facing the chuck. The template is mounted on a support bolted to the lathe apron.

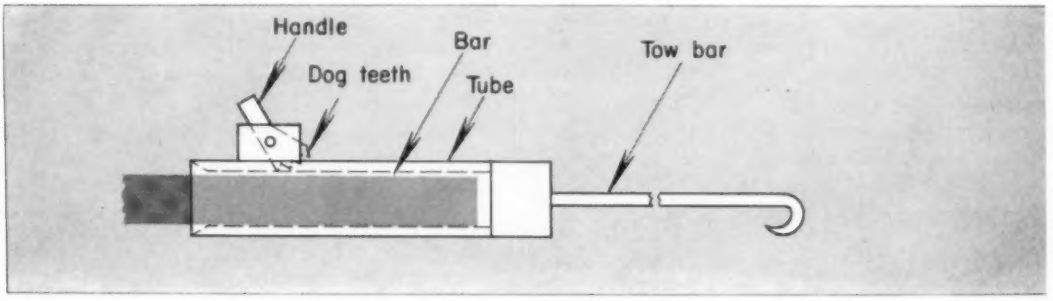
Concave surfaces are machined by facing toward the center of the work and feeding the compound in by hand. Concave surfaces are produced by facing from the center of the work toward the outside diameter.

Proper relationship between the template and the compound is maintained with the aid of a dial indicator mounted on the compound. When the anvil of the indicator is in contact with the template, there is a "zero" reading on the dial. By watching the dial, the lathe operator can make sure that the template is being accurately followed.

With the template, accuracy can be maintained within ± 0.001 inch. When lesser accuracy is required, a scriber can be mounted on the compound and used to follow a layout line, rather than a template.

F. G. Forquier
Keystone Chapter





Bar Gripper

In most plants and warehouses, removing round bars from racks involves hand labor with crowbars and chains. The gripper illustrated makes it possible to pull bars from the rack with an industrial truck. Construction features of the device are evident from the drawing.

A small crowbar is used to lift the bars in the rack just enough so that the tube can be fitted onto the end of the selected bar. The handle is then moved so that the dog teeth grip the bar securely and the bar is towed from the rack. This device saves a great deal of time and manual effort, particularly when the bar to be removed is at the bottom of the rack.

J. M. Breen
Pittsburgh Chapter

Drill Press Spindle Stops

When drilling a number of blind holes of the same diameter but different depth, the need for frequent measurements can be avoided by using a spindle stop. The turret depth stop illustrated in Sketch 1 permits accurate settings to be quickly made. This stop consists of a slotted block, drilled and tapped for a pinch type clamp screw, and a steel turret disk that rotates on a shoulder screw mounted in the slotted block. The block is threaded so that it can be screwed onto the depth stop screw. Four or more adjustable stop screws fit into tapped holes on the periphery of the disk.

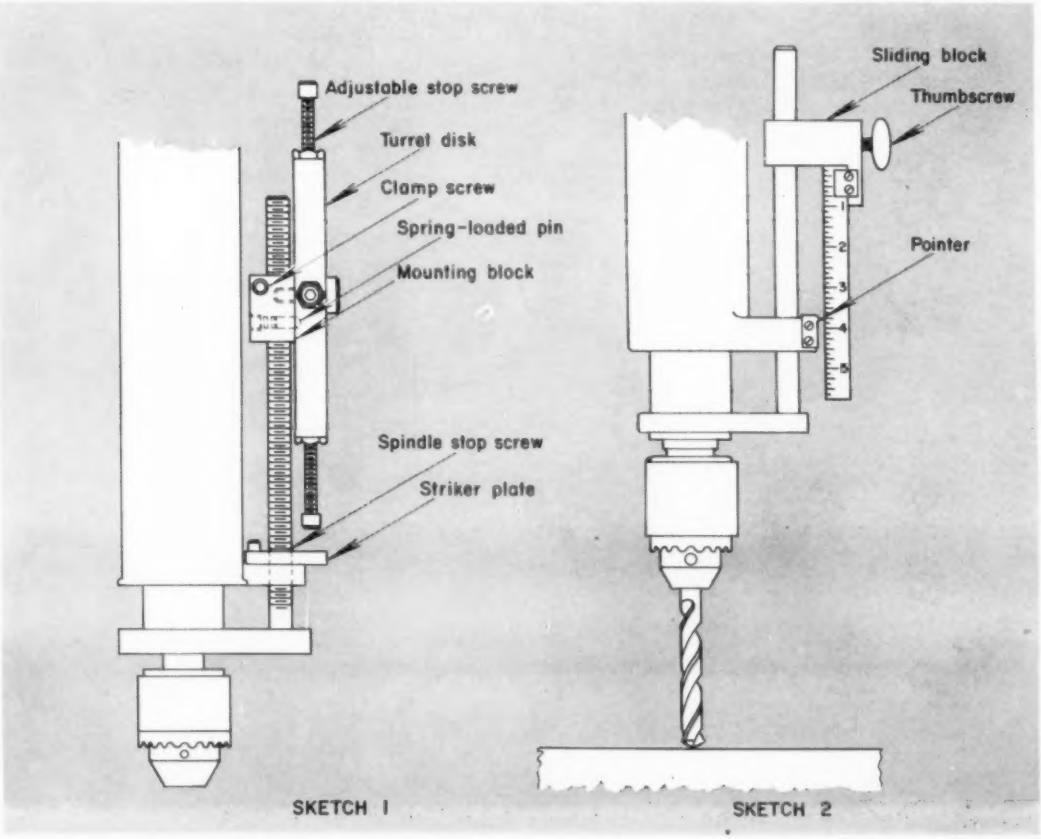
If necessary, a small plate can be added to act as a striker for the adjustable stop screws. In order to keep the turret disk in position, the block is drilled to accommodate a spring-loaded ball-nose pin. This pin enters detents on the inside face of the disk. It is sometimes convenient to identify the turret positions by number and to stamp corresponding numbers on the drill at each hole.

Drilling operations can also be facilitated by use of the stop shown in Sketch 2. The usual type of depth stop consists of a threaded rod and two knurled collars. Often, an inch scale is imprinted on a flat on the rod. These depth stops are inconvenient to use, since it takes a long while to thread the stop nuts from one end of the screw to the other. Also, the scale does not read directly; subtraction is required to make a setting.

In the stop shown, the threaded rod has been replaced by an unthreaded rod. A block is fitted to the rod and held in place with a thumbscrew that enters a keyway in the rod. This prevents the block from turning. A small scale is fastened to the block.

To use this device, the drill is brought down until it touches the work surface. Then the thumbscrew is loosened and the block is moved until the pointer is at the depth desired. Tightening the thumbscrew completes the setup operation. Since no calculations are necessary, the possibility of error is minimized.

Ernest Jones
Bronx, New York



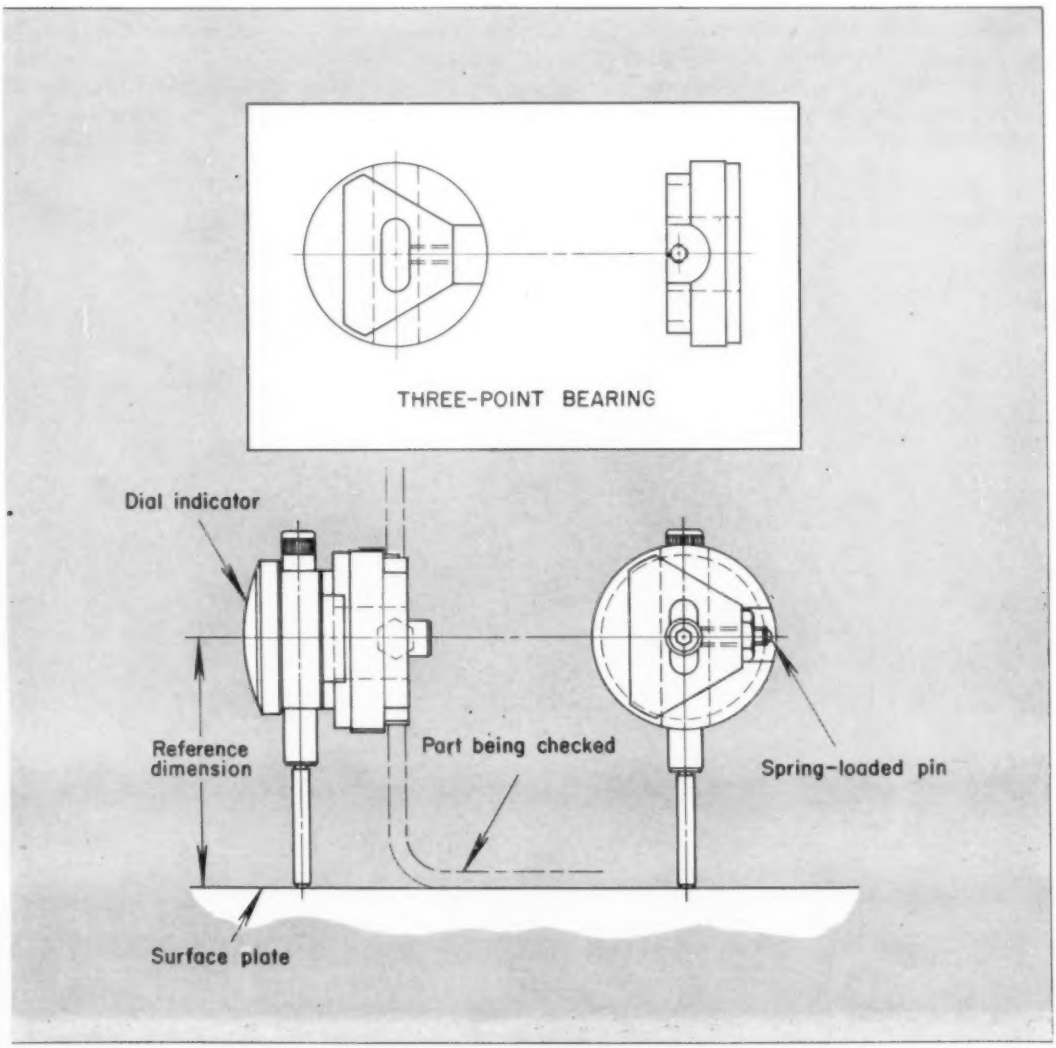
Hole Location Gage

Many production parts are designed and dimensioned so that it is necessary to check the distance from the center line of a hole to a flat surface. Making an accurate measurement can be difficult and time consuming. The gage illustrated is intended for checking such parts. It is especially well suited for checking production lots that are too large to be economically checked with standard gaging equipment, yet are too small to justify the cost of a special gage.

The gage consists of a three-point bearing to fit into the hole and a dial indicator. An accurately machined shoulder behind the bearing allows the gage to be squared against the wall of the part being checked. One of the three points is spring-loaded.

With the gage set to a master, measurements of parts are accomplished on a precision surface plate. With the three-point bearing in the hole, the distance to the surface plate can be read on the dial indicator. This type of gage is fast and accurate, yet is low in cost compared to most special location gages.

W. R. Eldridge
Little Rhody Chapter



selecting and maintaining HYDRAULIC FLUIDS

By C. R. Schmitt
Manager
Lubrication Dept.
E. F. Houghton & Co.
Philadelphia, Pa.

Selection of the proper hydraulic fluid for a specific application is affected by many factors. Basic service factors which affect this selection and the requirements for maintenance of fluids during use are outlined by author.

INCREASED USE of hydraulic fluids by industry has focused the attention of engineers on the types and requirements of fluids for specific applications. In the analysis of fluid characteristics and behavior, environment conditions are often overlooked. If an oil has high resistance to oxidation sludge formation, there is a tendency on the part of plant personnel to relax their efforts to maintain reservoir temperatures at proper levels and efforts to minimize contamination are relaxed. When using an oil that separates from water quickly, the possibility of water leaks from the coolers is often ignored. When using oils with low pour points, needed heating devices are sometimes eliminated, even though viscosity is high enough to interfere with proper funtioning of hydraulic equipment.

Petroleum Hydraulic Oils—Prior to Service

If the viscosity of a fluid is not within practical limits, it may not be possible to use the fluid in a hydraulic circuit powered by a particular type of hydraulic pump. Viscosity is related to pour point, viscosity index, and shear stability.

Pour point can be defined, practically, as the lowest temperature to which an oil can be subjected at which movement or flow can still be detected. It has little bearing upon the "flowability" of the oil through a hydraulic circuit.

Viscosity index is the indication of the degree to which a fluid thickens at low temperatures or thins at high temperatures. This property is the one which must be considered, together with viscosity and pour point, before reasonable decisions can be made concerning the suitability of a fluid for a given application. For example, a fluid having a pour point of 10 F may be so thick at 30 F as to be unsuitable for the service. However, if viscosity index is high enough, fluidity at 30 F will be sufficient to permit an adequate flow into the pump and throughout the system.

Lubricity is another important factor in the choice of a hydraulic oil. Since modern hydraulic pumps, valves and other components are so closely fitted and highly stressed, an oil having a high lubrication value is necessary.

Stability is the resistance to change from the original physical and chemical characteristics of the fluid. Such changes are evidenced by the formation of sludge, gums and resins which tend to collect in the system, plugging screens and valves and otherwise interfering with smooth hydraulic operation.

Other evidences of instability are foaming, increase in viscosity (thickening), or corrosion. Laboratories have devised many types of oxidation tests for evaluating oxidation stability. The best proof of this kind of stability is in the actual service record of the fluid under all types of conditions. One prac-

Die casting application where a water-glycol fire-resistant fluid is used as the hydraulic medium. The high temperature of the molten metal represents a fire hazard with standard petroleum-base fluids.

tical means of making a choice of hydraulic oil is to gather evidence from suppliers of several well-known types of fluids, then narrow the choice to two or three. At this point, the oils should be placed in comparable machines and given a thorough field service test.

Other properties such as color, flash points, flammability and specific gravity are important in ascertaining the over-all characteristics of a fluid. However, these factors have little or no significance with respect to the behavior of a fluid in the hydraulic system.

Maintenance During Service

There is no substitute for cleanliness in a hydraulic system. Use of oil filters and strainers, as well as air intake filters will pay dividends, not only in preserving the life of the oil but in protecting the delicate valves and pump parts of the hydraulic mechanism.

Air filters reduce the intake of foreign contaminants into the oil system, particularly in dusty or dirty atmospheres. Oil filters are desirable to remove minute particles that may cause chemical breakdown of the fluid or excessive wear on pumps and other components. With a good filter, service life of fluids is increased and the formation of oxidation products such as sludge, gum and resin is reduced.

Oil strainers, placed on the intake pipe in the reservoir, remove larger contaminants. From a mechanical point of view, these particles are definitely harmful to pump and valve surfaces. Generally, combining an oil filter with a cloth, cellulose or earth type of filter media, and a mesh or screen type strainer, is the best protection against circulating harmful material in the system.

Another type of "filter" is the magnetic plug. Several types are currently in use but, basically, all consist of permanent magnets placed strategically in the oil stream, usually before the oil enters the reservoir intake pipe. The function of these magnets is to remove extremely fine particles of ferrous materials which get into the oil either from the outside or as a result of component wear. These plug as-

Table 1—Water Savings Resulting from Flow Controls

Number of Machines Operating	Uncontrolled Flow Rate Per Machine (gpm)	Controlled Flow Rate Per Machine (gpm)	Total Weekly Conservation (gal)
1	3.9	1.0	29,232
10	3.9	1.0	381,744
3	4.1	1.0	93,744
4	8.9	4.0	197,568
1	8.9	4.0	49,392
1	8.9	4.0	49,392
3	8.9	4.0	218,454

semblies are inexpensive and are well worth the effort to install them.

Heat exchangers are important components in hydraulic circuits to control the operating temperature of the oil. Heat breakdown is reduced and proper viscosity is maintained during service.

Many users feel that heat exchangers are necessary only to reduce the deterioration of the oil during service. Proper maintenance of viscosity during service, however, is important. If an oil is permitted to thin out too much during service, a loss of pumping efficiency can result and vibrations may be set up in the pressure piping system. Such vibrations account for many leaks. Often a reduction of 10 or 15 F in the operating temperature of the oil reduces vibration to a minimum and, generally, improves the operation of the system.

The Joint Industries Conference (JIC) on Hydraulics recommends that the temperature at the pump inlet should be 130 F max. This specification provides a good rule-of-thumb to guide the user of hydraulic fluids.

Control and maintenance of cooling water through the unit should not be overlooked. The use of a Y-branch water filter in the cooling water line prior to entry into the heat exchanger removes solid particles from the water. Contamination includes rust picked up from the water lines, which would ultimately clog up the interior of the heat exchanger.

Another useful accessory is a solenoid shutoff valve wired across the pump motor electrical connections. When the pump is shut off, this valve is immediately closed, shutting off the water flow through the heat exchanger. This is important not only for economy, TABLE 1, but also for eliminating leakage of water into the hydraulic oil. When the water pressure in the water line is reduced to zero, the possibility of leakage of water from the cooler into the oil line is minimized. Leakage often is caused by pinhole openings in the exchanger tubing. During hydraulic operation, the hydraulic pressure in the oil line will usually be sufficient to eliminate the possibility of a water leak into the oil line.

Service Period

Precise figures on service life of hydraulic oils are difficult to obtain, but a rule-of-thumb measurement might be helpful. Items which will serve as a guide in this respect are viscosity (allowable increase—20 percent); sludge (precipitation—2 percent max); and neutralization or acid number (1.0 mg KOH max). These criteria should be qualified somewhat by the statement that in analyzing used hydraulic oils all three items are considered in arriving at a definite conclusion about the fitness of the oil for further use. For example, if the oil increases 20 percent in viscosity, but the other two items remain within limits, it is possible that no deterioration has taken place. Perhaps the oil has simply been contaminated by an oil of heavier viscosity. An example of a test of oil contaminated by various materials is shown in TABLE 2.

Hydraulic Reservoirs

Too little attention is given to the construction of the hydraulic reservoir, which cannot be regarded merely as a storage tank for the oil prior to use in the system. The reservoir should be constructed to act as a heat exchanger, as well as a settling basin for contaminants, particularly where provisions for filtration are inadequate. Another function of the reservoir is to permit air or gas entrapped in the fluid to escape. Some systems equipped with accumulators have nitrogen gas in direct contact with the oil. Therefore, it is essential that the entrapped gas reaching the reservoir be permitted to leave the oil. The reservoir must be properly baffled and of sufficient size to permit the oil to come to rest long enough for this to occur.

Another design feature needed to obtain optimum performance is the grouping of return lines to the reservoir remote from the intake line to the pump. As oil returns from the system, it is directed against the side of the reservoir. Heat is transmitted to the metal sides of the reservoir and dissipated to the outside air. The baffling should require the oil to take a leisurely route through the reservoir before being taken into the intake pipe for another trip through the circuit. Adequately sized covers properly placed on the reservoir permit inspection of the interior, as well as access to the intake pipe strainers for proper maintenance. Contamination from air and other substances such as cutting lubricating oils should be eliminated by providing the covers with proper fasteners.

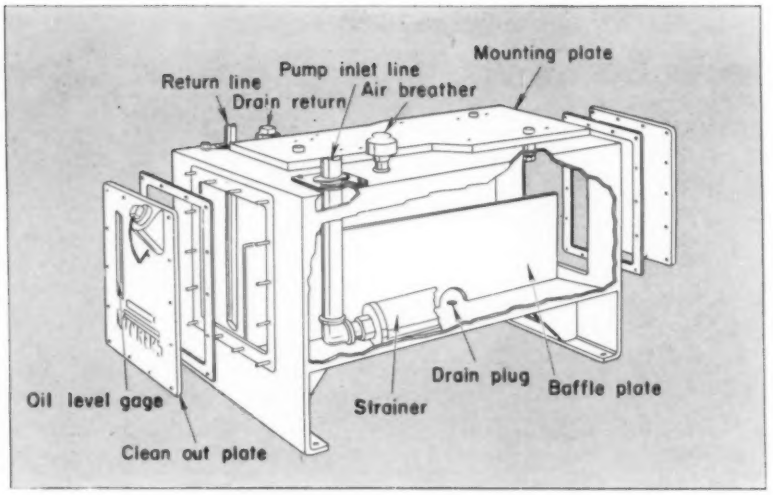
Table 2—Effect of Catalysts on Oxidation Rate of Oil

Catalyst	Run (hours)	Neutralization No. (mg)*
None	3500	0.17
Water	3500	0.90
Iron	3500	0.65
Iron & 6% H_2O	360	8.10
Copper	3000	0.89
Copper & 6% H_2O	96	11.20

*New oil before test—0.01

Fire-Resistant Fluids

There are three different types of fire-resistant fluids available for hydraulic applications; namely, water-glycol, phosphate ester and phosphate ester



Construction of a hydraulic fluid reservoir showing the various components needed for cleanliness and efficiency of the system.

base and the water-in-oil emulsions. Water-glycol types are solutions of water and glycol type thickeners, compounded with suitable additives and rust inhibitors to make them suitable for hydraulic systems. High resistance to spray flammability, high viscosity index, low pour point, compatibility with conventional types of packings and seals, high heat conductivity and medium cost are characteristics of this class of fluids.

Phosphate ester and phosphate-ester-base fluids are characterized by being straight synthetic materials which contain no water and are inherently fire resistant. Being made from chemical materials normally used for lubricity purposes, they are good lubricants and adaptable to installations where petroleum oil has been satisfactory. The phosphate ester and phosphate-ester base-fluids require special packings and seals, being incompatible with those generally used with petroleum oil. Low viscosity indexes mean more care must be taken in selection for specific hydraulic applications, particularly where the temperatures encountered fluctuate over a wide range.

One of the commonly used fluids, a phosphate-ester-base material, incorporates a viscosity index improver. Experience with such improvers has shown that they tend to revert to the original characteristics of the base fluid after a relatively short period in service.

Phosphate ester and ester-base fluids are relatively costly which means that their use is usually governed by the conditions of the hydraulic system. These fluids generally apply when water-base fluids cannot be used.

The water-in-oil emulsion fluids interest many hydraulic users because some fire resistance is combined with relatively low cost. In these fluids, the oil acts as the continuous phase with the water contained in tiny droplets of oil. Because of the water content, burning is resisted since, under ordinary conditions, the water acts as a snuffer or steam blanket to prevent the oil from burning when the emulsion breaks down.

Water-in-oil emulsions are characterized by compatibility with oil type seals and packings and higher heat conductivity than petroleum oil. They are the lowest priced of all the fire-resistant fluid types. As emulsions, they are relatively unstable. Freezing, excessive heating, or long periods of standing can cause contamination. Pump wear with emulsion fluids is greater than with the other two types but the fluids have been found to be suitable for many lower pressure installations found in industrial systems.

Important considerations when contemplating a change-over to fire-resistant fluids are pipe compounds and paints used near or in the system. Special pipe joint compounds are required for the various fluids. Water glycol, phosphate ester and phosphate-ester-base materials are not compatible with oil-resistant paints. Information on the proper sealing compounds should be obtained from the supplier.

Care in changing over from petroleum oil to fire-resistant fluids is of the utmost importance. Cleanliness should be a rule and the supplied directions for change-over by a fluid manufacturer are the result of several years' experience in practical applications. Before changing over to any fire-resistant fluid, the supplier should be requested to survey the equipment or should be given the details concerning the models of the pumps involved, the operating temperatures, pressures and all other pertinent system data. Recommendations can be made as to the suitability of the fluid, on the basis of the conditions present, for use of one of the three types determined to be best suited from the standpoint of performance and price for the existing equipment.

RESIDUAL GRINDING STRESSES can be minimized

By M. W. Gormly*

Grinding tests indicate that significant amounts of metal can be removed from a workpiece without inducing serious residual stresses. The author reviews some of the research work in this field with the practical implications of the studies on these stresses.

INCREASED NEED for precision products have made greater demands for finishing processes like grinding. It is well known that to produce high-quality ground parts requires careful work by a good machine operator. Efforts have been made to define a good ground part. To obtain this data, the effects of grinding have been studied relative to surface stresses and failures which may result from abusive grinding practices.

Sources of Premature Failure: A shaft can be stretched or bent by a load which is well below its maximum strength and will not break or be permanently deformed. However, if this load is applied, released and applied again repeatedly for millions of cycles, it may fail due to fatigue.

Such a failure indicates that obscure and variable factors determine the life of a particular part. Cracks, flaws and inclusions are responsible for many premature failures. Also, residual tensile stresses within a few thousandths of an inch of the surface have been thought to be partly responsible for a decrease in fatigue life.

*Member of the Research Technical Subcommittee of the Grinding Wheel Institute and Abrasive Grain Association, 2130 Keith Bldg., Cleveland 15, Ohio. This article is based upon research sponsored by these organizations at the Mellon Institute of Industrial Research.

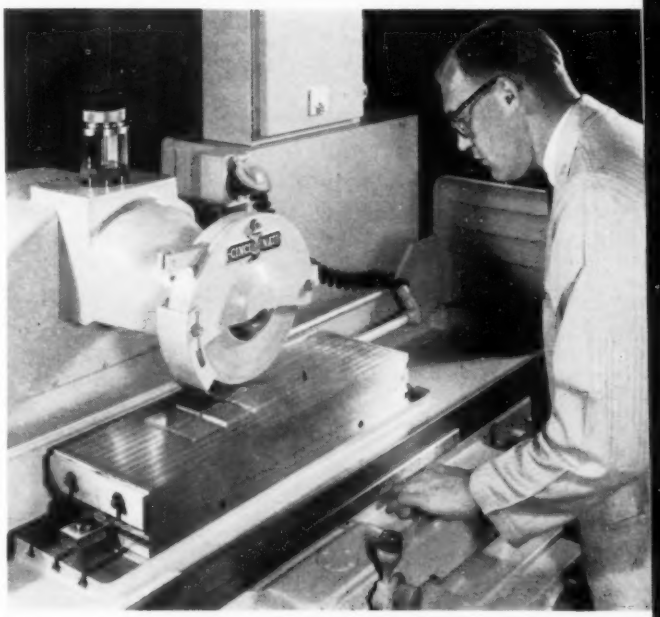


Fig. 1. Test grinding setup of specimens for measurement of residual grinding stresses.

Residual stresses are often locked in as a result of operations like heat-treating, machining, peening or grinding, *Fig.* 1. The presence of stresses has been known to cause distortion or cracks such as may appear during heat treatment. These stresses, which can be high and concentrated in a thin layer at or immediately below the surface, influence life if the magnitude and depth of the stress are sufficiently great.

Grinding Stress Research: Studies have included investigations to determine the effects of severe grinding stresses upon fatigue strength. In a paper[1] that resulted from this program, it was reported that severe grinding results in relatively high residual tensile stresses near the metal surface and causes a slight reduction in fatigue strength of hardened bearing steel. It was also shown that the type of residual stress distribution resulting from good

[1]References are listed at end of article.

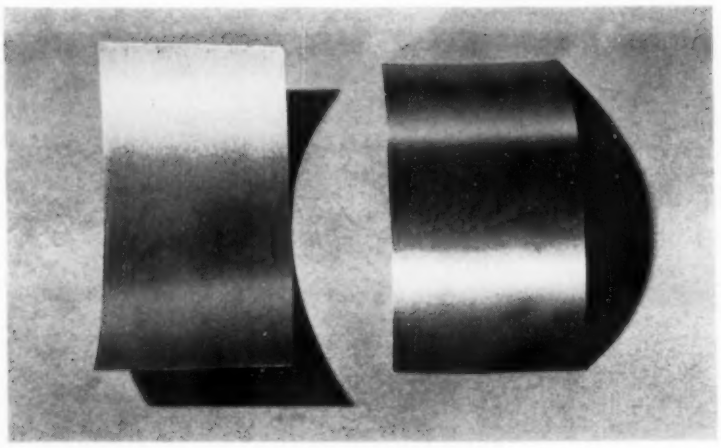


Fig. 2. Shim stock, left, ground to produce tensile stress near the top surface, causing concave curvature of the ground surface. Shim stock, right, ground to produce compressive stress near the top surface causing convex curvature of the ground surface.

grinding is not detrimental to fatigue strength.

The nature of these test results necessitates definition of the difference between severe grinding and good grinding practices. Research showed considerable difference in stress distribution resulting from differences in the grinding severity. Part of this work is reviewed because of its importance in estimating the magnitude of stresses and their effect.

The stress measurement technique developed and used for this research is commonly referred to as the deflection method. It uses the fact that tensile or compressive stresses at or near the surface of a flat strip or plate of metal will distort or curve the metal until an equilibrium is reached in stress distribution. Tensile stress near the top surface in the piece of shim shown in *Fig.* 2, left, causes the curvature. It should be emphasized that the curvature shown is extreme since the tensile stress is present in a substantial portion of the thickness of this thin shim stock. In thicker specimens, such as ¼ inch, the curvature must be measured with precise instruments. Compressive grinding stresses and the effect on thin shim stock are illustrated in *Fig.* 2, right.

To demonstrate the effect of severity of grinding conditions on residual stress distribution and on the resulting curvature of the specimens, experiments[2] were performed at a number of different metal removal rates. Samples of annealed manganese oil-hardening tool steel were used as test specimens. A reciprocating table surface grinder, *Fig.* 1, was used to remove a layer of specified thickness from each sample. By shimming the various specimens to different heights on the magnetic chuck, all specimens were ground simultaneously. The desired depth of cut was made on each in a single crossfeed. Other grinding condtions were as follows: wheel size, 8x½x1¼ inch; wheel type, white aluminum oxide, vitrified; wheel speed, 6000 sfm; traverse speed, 50 fpm; crossfeed, 0.050 inch at each end of traverse; and grinding fluid, air.

The curvature of each specimen was measured before and after grinding so that the change in curvature induced by grinding stresses could be determined. These measurements are plotted, *Fig.* 3, against depth of cut. It was observed that the greater depths of cut (more severe grinding conditions) produced greater curvature in the specimens, presumably resulting from residual stresses.

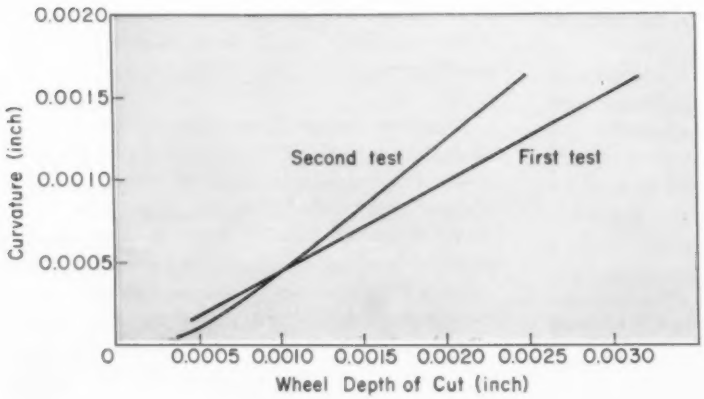


Fig. 3. Effect of wheel depth of cut on curvature of 2 x 2 x ¼ inch annealed manganese oil-hardening tool steel specimens after grinding.

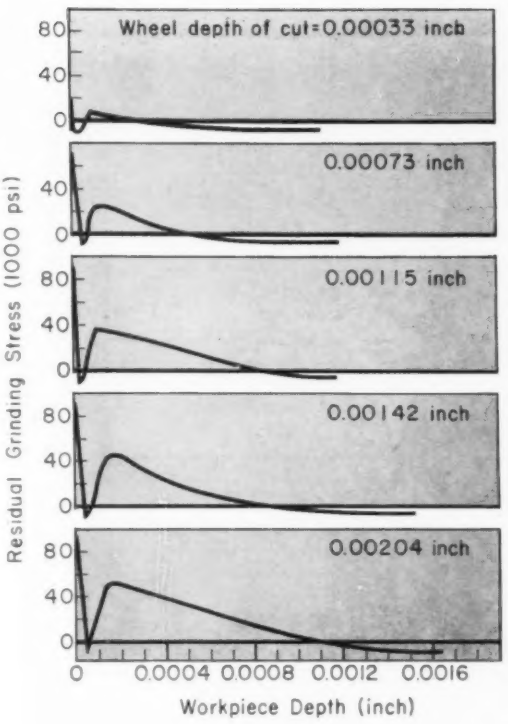


Fig. 4. Residual stress distribution patterns, parallel to grinding direction, in annealed oil-hardening tool steel showing effect of wheel depth of cut. Positive stress values (above zero axes) are tensile; negative values are compressive.

Stress Distribution: In a second test, employing the same grinding conditions, the magnitude of residual stress was determined at various depths below the ground surface of each specimen. This stress was measured by etching the surface and determining the change in curvature resulting from release of the forces in each layer. From this information, the stress in each layer was calculated. These stress values are plotted against depth to give stress distribution curves, *Fig.* 4.

The stress distribution curves confirm the conclusion drawn from the data in *Fig.* 3 that the more severe grinding conditions leave higher residual stresses in the metal. There are three significant stress factors which are related to depth of cut: stress at the surface, peak tensile stress below the surface, and depth of stress penetration. These stress factors increase with increase in severity of grinding.

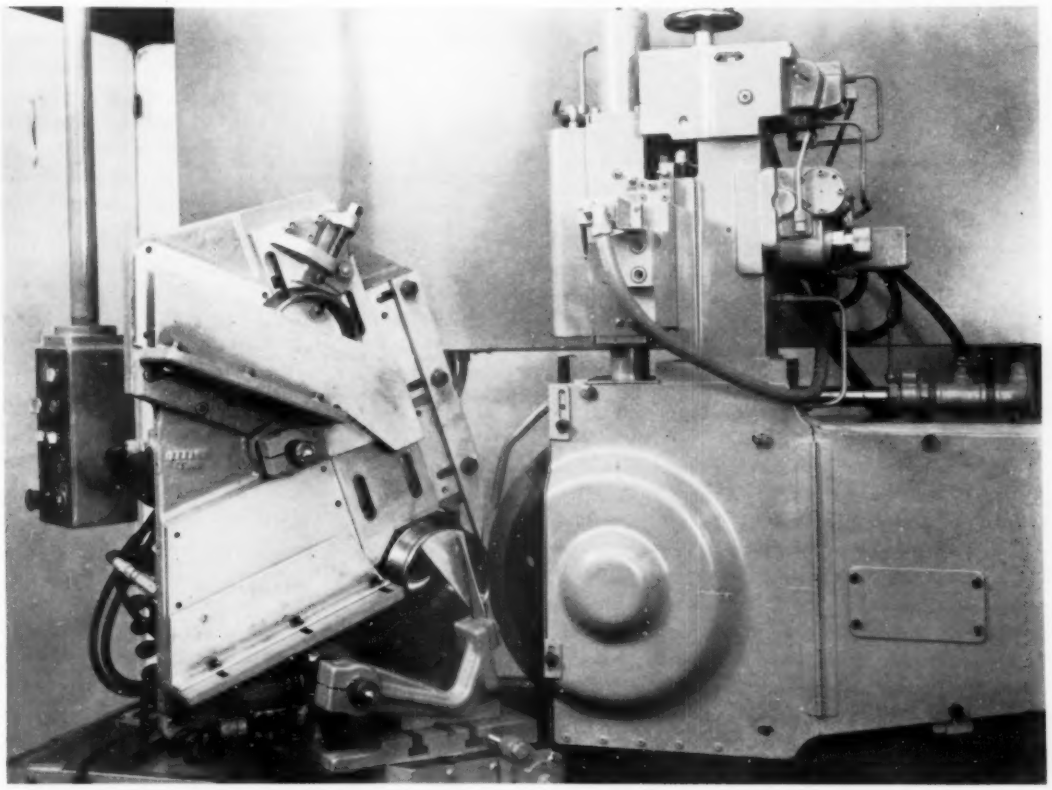


Fig. 5. Production setup for grinding OD of inside races for tapered roller bearings. Careful programming of grinding cycle insures uniform product quality as well as uniform production rate.

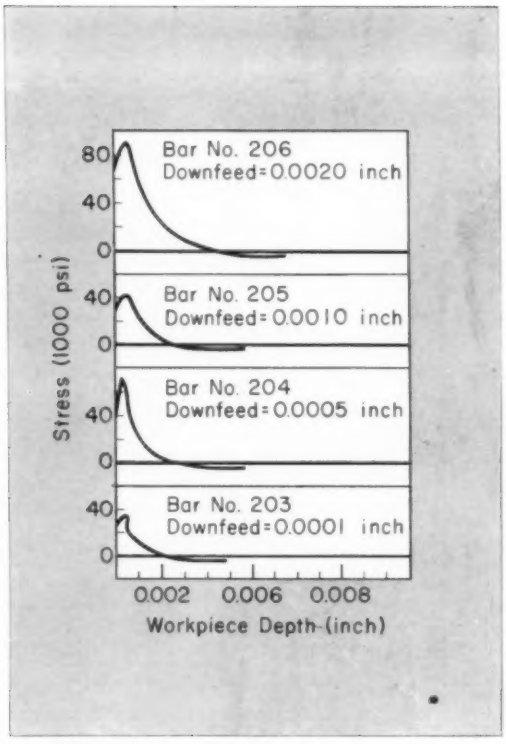


Fig. 6. Effect of unit downfeed on grinding stresses, parallel to grinding direction, in R. 59 bearing steel. Positive stress values (above zero axes) are tensile; negative values are compressive.

Stresses in Hardened Steel: The same conclusion that severe grinding practice is undesirable may be drawn with regard to hardened steel. For example, data[3] obtained from ground specimens of 52100 type bearing steel hardened to R. 59 is shown in *Fig.* 6. Both the magnitude and depth of penetration of the grinding stresses increase with increasing unit downfeed. In the hardened steel, the depth of stress penetration is less than with annealed steel. Tensile stress in the hardened steel decreases rapidly as the surface is approached, whereas it increases rapidly in the annealed steel at this point.

The hardened steel specimens were ground, one at a time, at unit downfeeds of 0.0001, 0.0005, 0.001 and 0.002 inch. Approximately 0.010 inch was removed from each surface in the test grinding. The wheel was freshly dressed before grinding each surface, using a 0.001 inch downfeed and a moderately rapid crossfeed of the diamond to leave an open wheel face. In this case, a 46 grit, H grade wheel was used. The wheel speed was 6000 sfm; traverse speed 60 fpm, and the crossfeed of 0.050 inch at the end of each traverse. An oil-water emulsion was used as the grinding fluid.

Previously, it had been determined that removal of 0.010 inch from each surface during test grinding would completely remove any residual stresses created in preparation of the specimens. Other grinding stresses produced early in the test grinding would be removed or modified in subsequent passes.

This fact is particularly important to the commercial user of grinding wheels since it offers a means of removing significant amounts of metal in reasonable lengths of time without inducing serious residual stresses. For example, in the test grinding at 0.0001 inch and 0.0005-inch unit downfeed, 0.001-inch downfeeds were used at the start of the test, tapering off to the specified downfeed as the desired size was approached. The nature of the stress distributions in specimens so ground demonstrates that workpieces were not measurably affected by the heavier downfeeds used at the start of the test.

It should be noted that the total metal removal in this test was relatively small. In another test, sufficient metal was removed to dull the wheel. In that case, the stresses resulting from light downfeeds were just as high as those resulting from heavier feeds. Therefore, following heavy stock removal, it is essential that the wheel be dressed before finish grinding at light feed rates if benefits in stress distribution are to be realized.

Returning to the influence of grinding stresses on fatigue strength, residual stress distributions and corresponding grinding conditions, represented in *Fig.* 6, have little or no effect on the fatigue of these specimens. In fatigue specimens ground similarly to Bar No. 205, *Fig.* 6, except using an I grade to an H grade wheel, stress distribution is similar to that in Bar No. 205 with no effect on fatigue strength. The only case in which there was a reduction in fatigue strength involved specimens ground with an M grade wheel at 0.002-inch-unit downfeed. These specimens had a peak residual tensile stress 30 percent higher than that shown for Bar No. 206, and under these severe conditions the reduction in fatigue strength was only 13 percent.

Based upon this research it may be concluded that: stress produced by grinding does not decrease the fatigue strength when good grinding practices are used. Also, grinding conditions which produce excessive residual tensile stress to the detriment of fatigue strength would also be regarded as excessively severe by any good grinder operator.

Bibliography

1. Tarasov, L. P., Hyler, W. S., and Letner, H. R.—"Effect of Grinding Conditions and Resultant Residual Stresses on the Fatigue Strength of Hardened Steel," ASTM Preprint No. 65, 1957.

2. Letner, H. R., and Snyder, H. J.—"Grinding and Lapping Stresses in Manganese Oil-Hardening Tool Steel," *Transactions*, American Society of Mechanical Engineers, Vol. 75, 1953.

3. Letner, H. R.—"Residual Grinding Stresses in Hardened Steel," *Transactions*, American Society of Mechanical Engineers, Vol. 77, 1955.

Measuring Scratches Accurately

. . . reduces rejects

By Bobly Siebel and Fred R. Miller
Manufacturing Research
Boeing Airplane Co.
Seattle, Wash.

Inadequate means of checking depth of scratches on aircraft tubing was responsible for an inordinate number of rejects at Boeing. An optical method of measurement insured an accurate check and saved many good parts from the scrap heap.

Fig. 1. Scratch depth indicator used to examine the skin of a bomber. Indicator is light and battery case may be carried in a coat pocket.

RELIABILITY REQUIREMENTS for aircraft force stringent control methods for assuring the quality of tubing surfaces. Because a tiny scratch can cause fatigue failure, any aluminum tubing with a surface scar deeper than ten percent of the wall thickness must be rejected. The allowable scratch depth for stainless steel is even less than that for aluminum since stainless is used for more severe service. The average thickness of aluminum aircraft tubing is 0.030 inch. The stipulated scratch depth limit means, therefore, that a scratch 0.003 inch deep will send a part to the scrap pile.

Measuring Scratches: A check by the quality control department at Boeing revealed that inspectors were discarding tubing mainly on account of surface scratches. No adequate and reliable instrument was being used to check scratches, although several were tried and each discarded.

One way to measure a scratch is to make a plaster mold of the surface, remove the mold and measure the distance from the base to the peak of the impression. The peak, however, is extremely fine and has a tendency to break when the cast is parted from the scratched material.

Numerous attempts had been made to design a gage and Boeing had tried out one such tool, a scratch "probe." The probe, fundamentally, was a needle attached to a small indicator. A light set in the top of the probe was supposed to blink when the allowable scratch depth was exceeded. Sometimes the gage worked, but often, when the scratch was checked a second time, the bulb did not light.

Another gage constructed by a British firm of optical instrument makers was tested. The smallest increment of measure was 0.003 inch, which fell far short of requirements. An instrument was needed capable of gaging any scratch between 0.030 and 0.00005 inch deep.

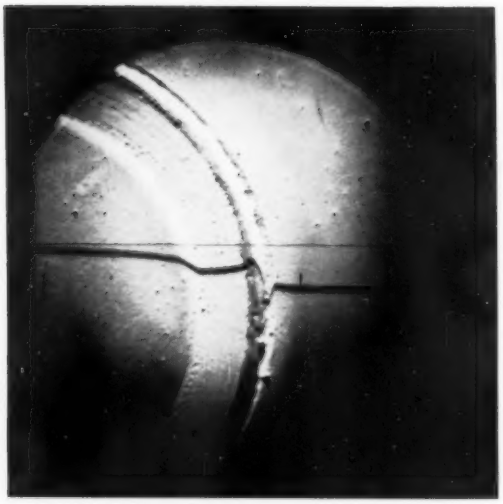


Fig. 2. A hairline shadow is projected into the scratch valley. Measurement of the shadow deviation gives scratch depth to 0.00005 inch.

With no scientific method to use, inspectors resorted to the "fingernail test." The owner of the fingernail would pass it back and forth over the scratch, and judge the depth of penetration by feel. The build-up along the sides of a scratch may make it feel deeper than it is in actuality. Variations from man to man and even from finger to finger, in the thickness of nails, make it a foregone conclusion that this guesswork method will not result in the same depth "reading" from any two men. Inspectors and shopmen became involved in debates as to whether a particular scratch was or was not beyond allowable depth.

An Optical Method: The optics group in the manufacturing research department was asked to develop a gage which would be a precision instrument. The gage had to be small, compact and light weight so that it could be carried to any part of the plant, used in cramped quarters and held in any position by the operator. It had to be simple, allow-

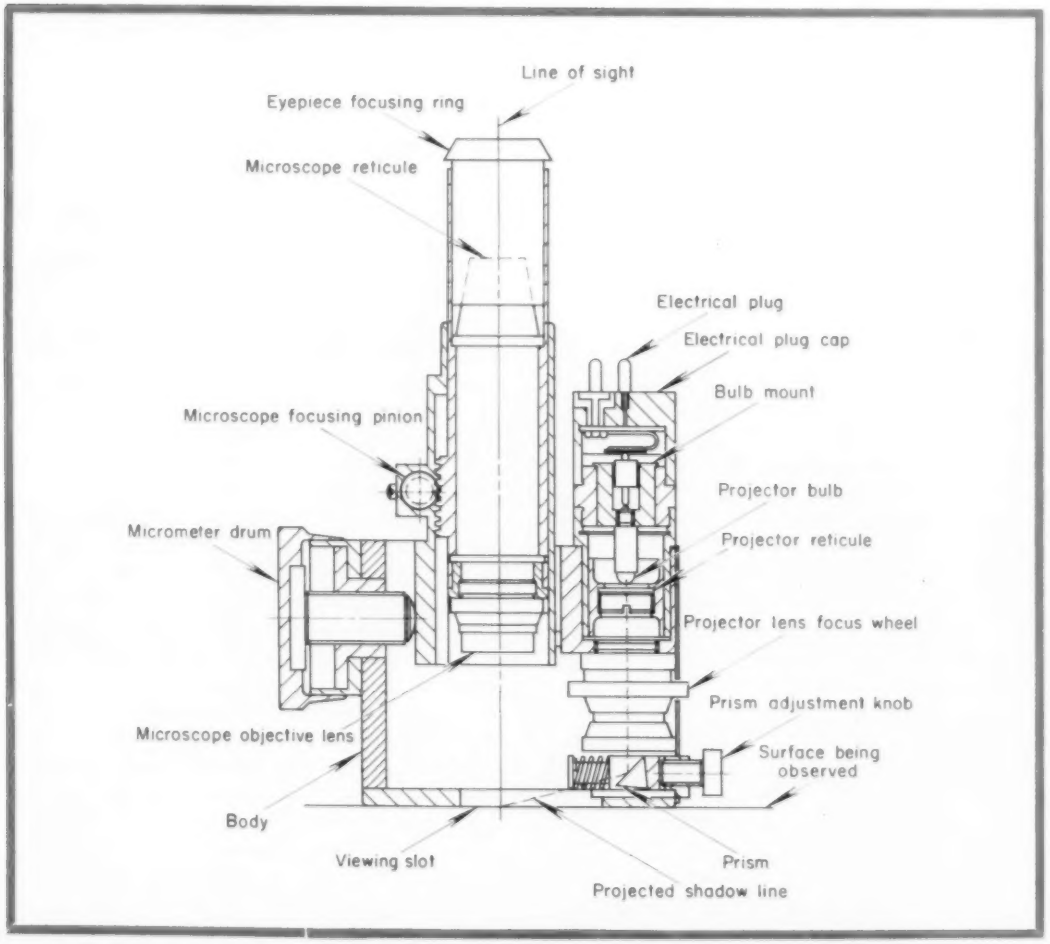


Fig. 3. Cross section of scratch depth indicator. The micrometer drum is calibrated to read directly.

ing untrained personnel to take readings accurately within ± 0.00005 inch.

A gage was developed that in effect solves a trigonometrical problem and is shown in use in *Fig.* 1. The principle on which it works is the same one that an astronomer uses to calculate the depth of a crater on the moon. By means of a prismatic lens, and a projector light bulb, a reticule hairline casts a shadow into the scratch valley being gaged. *Fig.* 2. The hairline is magnified some thirty-five times. With the micrometer drum set at zero, the projected shadow line is brought into coincidence with a microscope reticule. The drum, shown in the instrument cross-section in *Fig.* 3, is rotated until the reticule becomes coincident with the point of the V-shaped shadow. The drum is so calibrated that the depth of the scratch can be read directly to 0.0001 inch and interpolated to within 0.00005 inch.

Because of glare, it's hard to distinguish the shadow line when viewing highly reflective surfaces through the gage. A thin coat of casein titanium white or $Ti\ O_2$, diluted one part water to one part white, is brushed on the surface to be examined. It sets in two or three minutes, and is easily removed with a damp cloth.

Only an inch and one-half wide, the scratch depth gage is four inches long, while the eyepiece of the microscope stands about seven inches above the base. The tool fits handily into the side pocket of a man's coat. Its weight is about two and three-quarters pounds. A small dry battery powers the projector light bulb. The whole unit, including battery, tube of casein titanium white and carrying case, weighs about twelve pounds.

The gage is expected to be extensively applied in the aircraft industry, not only for measuring scratch depth, but checking flushness of rivet heads and gaging thickness of paint. The gage, *Fig.* 4, can be used for precision measurements on a metal bond panel, a plastic part, a glass window, a stainless steel tube, or a curved aluminum skin. These examples are by no means a limit to the uses.

Fig. 4. Scratch depth indicator developed by Boeing reads scratch depth easily and accurately. The instrument is simple and requires no training to use.

designed for

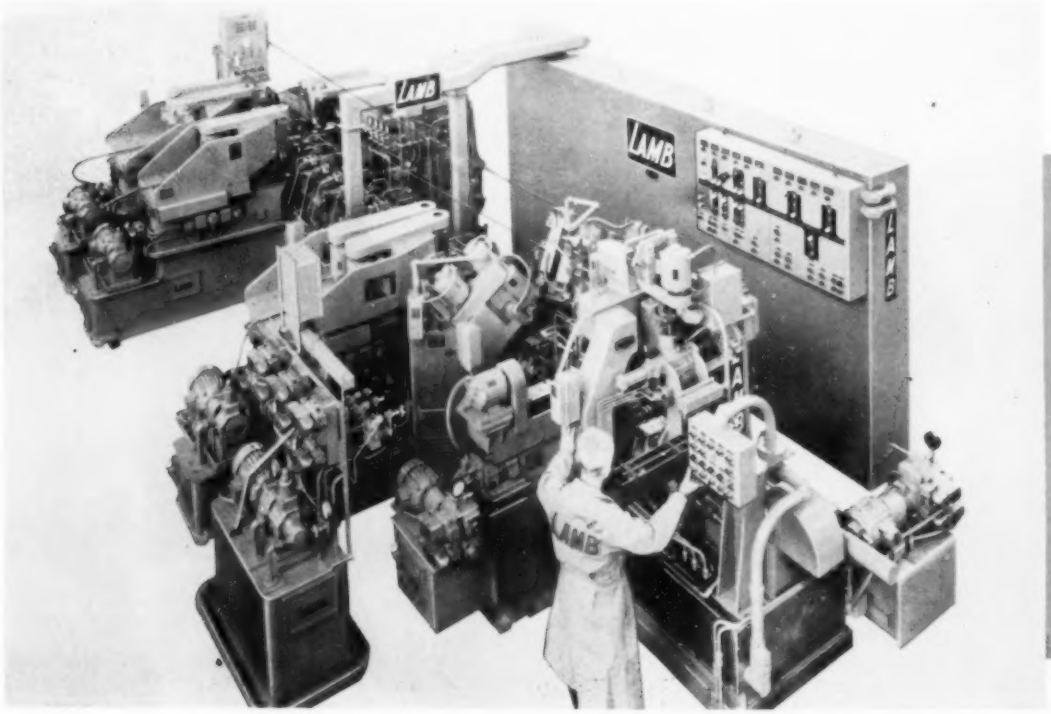
PRODUCTION

Pressure-Regulated Clamping Prevents Piston Distortion

Preventing distortion of pistons during machining requires careful handling of the parts. In a special walking-beam type machine, designed and built by F. Jos. Lamb Co., part distortion is prevented by using multiple clamping as an integral part of the fixtures.

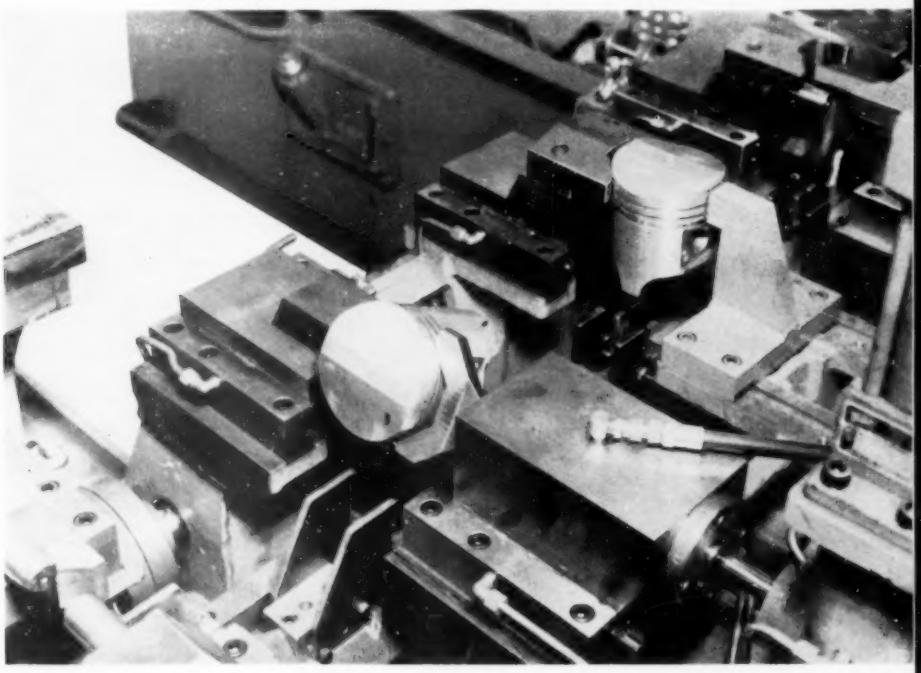
The machine receives turned and grooved pistons with the dome down. In this position, the radial position of the wrist pinhole is tested and reorientation of the part is made if necessary. Machining operations include boring of the wrist pinhole, drilling a processing hole in balance bosses and oil holes in the wrist pin bore, milling two slots, rough milling two balance bosses, rough and finish milling two angular flats on the piston dome. In addition, the machine probes all drilled holes and gages all pistons to check and mark each part exceeding specified machining tolerances.

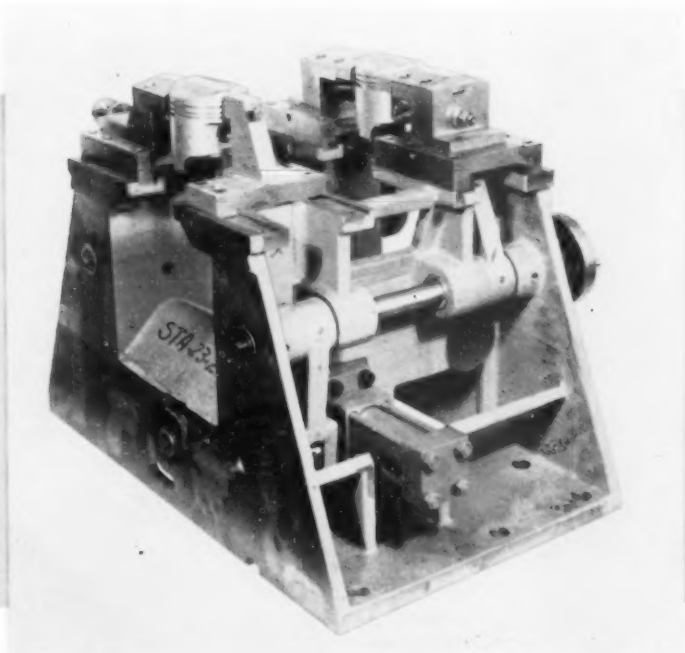
The multiple clamping arrangement on the fixtures actuates four clamp stations with one mechanism as an integral part of the fixture. Through a mechanical linkage, a hydraulic cylinder moves the slides in and out. Clamping pressure is adjustable and limited by a pressure regulating switch.



PISTON TRANSFER MACHINE performs multiple boring, drilling, milling, gaging and marking operations on 450 pistons per hour.

TURNOVER FIXTURE receives piston with dome down and rotates part to dome up for milling operation. Angular flats on dome are milled relative to the wrist pinhole for location.





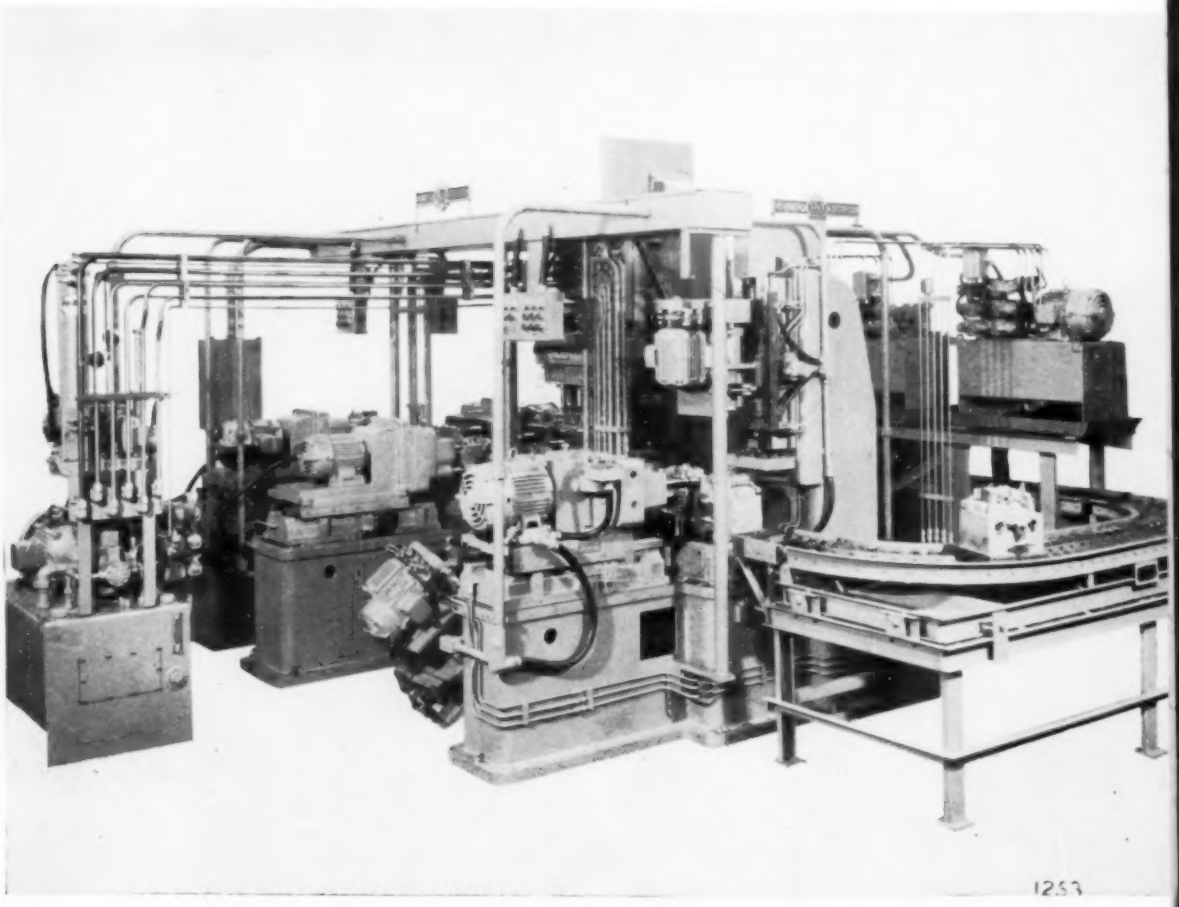
HOLDING FIXTURE for pistons showing mechanical linkage for actuating multiple clamps to equalize forces during machining.

Packaged Hydraulic Units Simplify Maintenance

By using package components and manifold mountings on hydraulic systems, maintenance on transfer machines and subsequent down time can be reduced. In a hydraulically operated transfer machine designed by Rehnberg-Jacobson, these principles were applied.

Each two units in the 13-station machine are operated from an individual hydraulic power unit. These units are mounted over the fixture return conveyor to conserve floor space. The high mounting prevents drainage from oil from the operating cylinders, insuring a full system at all times and avoiding the possibility of entrapped air. Pallet mounting was used to permit removal of any particular power unit and substitution of another during maintenance.

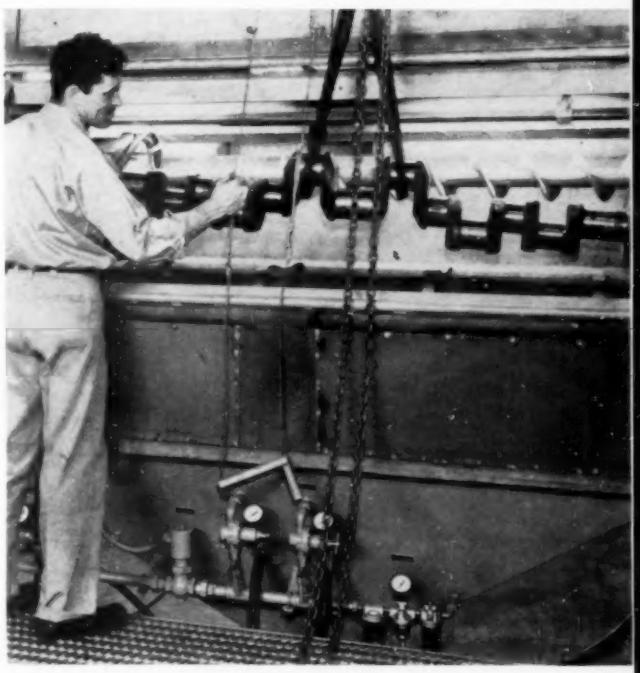
Deceleration and feed valves are manifold mounted directly on the station feed unit rather than on the tank unit. This arrangement permits easier setting of feeds on hydraulic drive units. Also, all cylinders on the hydraulic units are manifold mounted to allow cylinders to be removed without disturbing the piping.



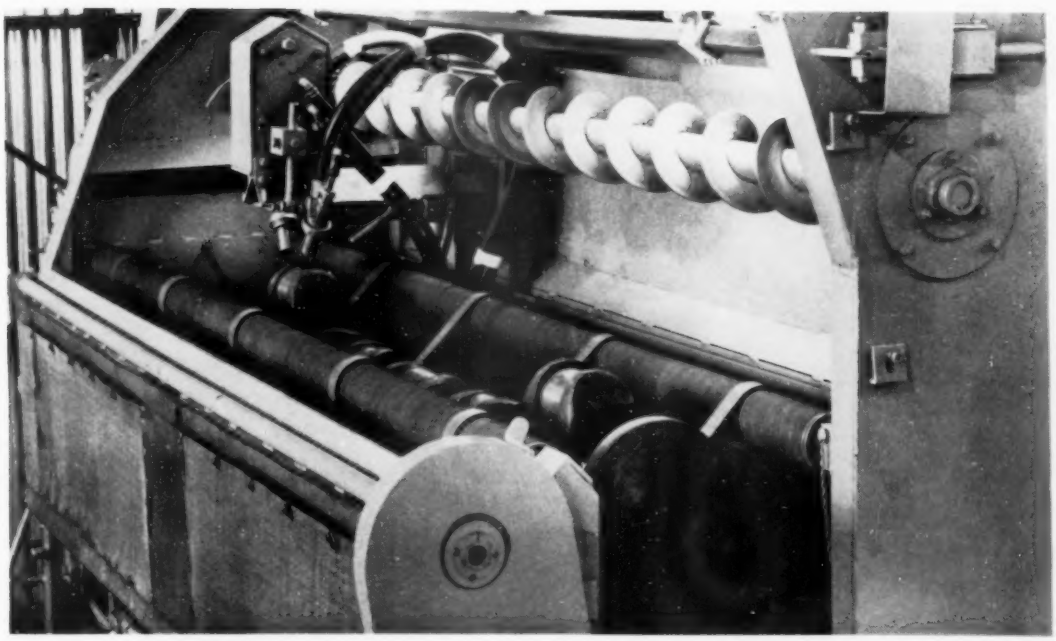
Helicoid Conveyor Drives Shot-Peening Nozzle Carrier

Shot peening of new and rebuilt crankshafts before chrome plating of journals increases the fatigue strength of engine crankshafts. In an automatic shot-peening machine, built by Metal Improvement Equipment Co., crankshafts up to 16 inches in diameter swing and up to 7 feet long can be processed without any special jigs or fixtures.

During the automatic peening cycle, the crankshafts are lowered directly on drive belts that support and rotate the workpiece. The workpiece is shot peened by two oscillating nozzles as they travel the length of the crankshaft for one round trip. The nozzle carrier is driven by a helicoid conveyor used as a shotproof lead screw.

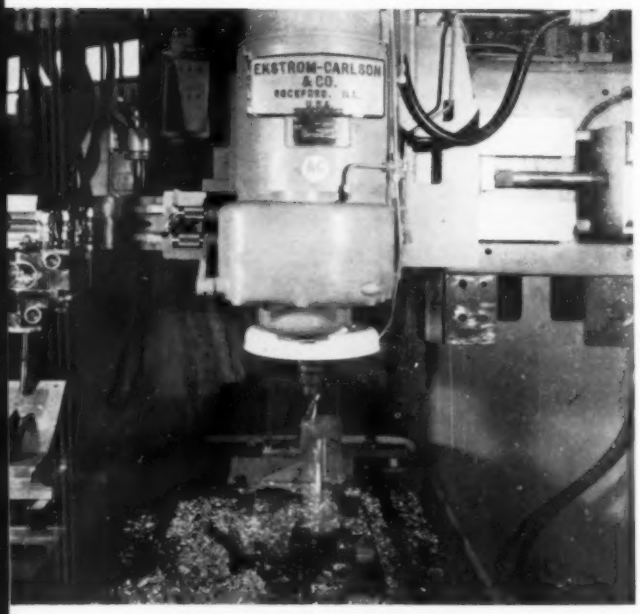


CRANKSHAFT being loaded into shot-peening machine by operator.



WORKPIECE in operating position with oscillating nozzle ready for cycling. The Helicoid drive conveyor for a nozzle carrier is mounted at the top of the machine.

Special Motor Speeds Contour Milling Operation



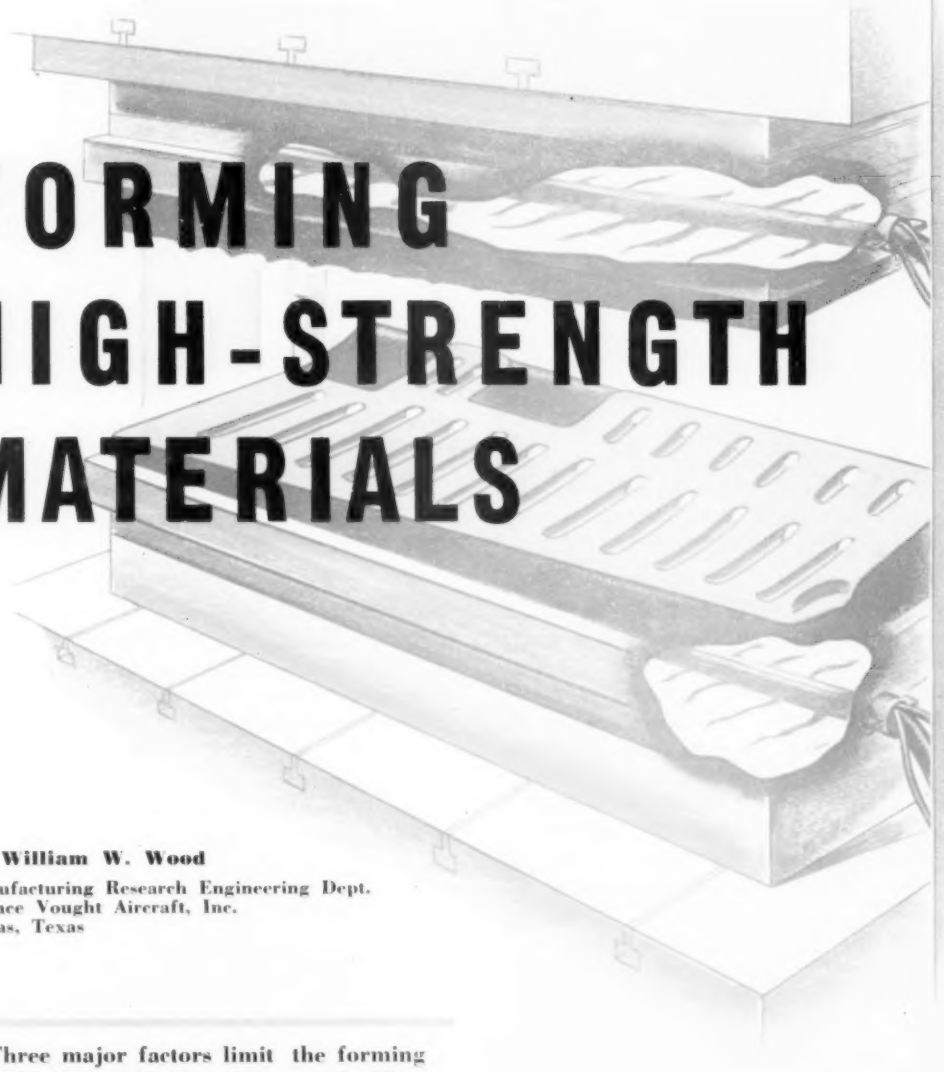
D-C MOTOR on a profile milling machine. Outer shell of motor is a water jacket for cooling. Low-pressure oil mist system provides lubrication for ball bearings on the spindle.

Increasing use by the aircraft industry of steel, titanium and other high-strength materials in addition to aluminum and magnesium has created the need for more versatile machine tools. A shell type water-cooled d-c motor with a speed range of 50 to 6000 rpm has added this versatility to a profile milling machine.

The variable speed of the motor permits machining various grades of aluminum, steel and titanium at optimum speeds for maximum production and cutter life. Speed of the motor is varied from 50 to 1500 rpm with armature control. From 1500 to 6000 rpm, control is obtained by magnetic-amplifier field-weakening. The control provides overload protection, field loss protection, IR compensation, overvoltage protection and dynamic braking. The unit was developed jointly by Allis-Chalmers Mfg. Co. and Ekstrom-Carlson & Co.

MAGNETIC amplifiers and rectifiers provide a static control system for d-c motor. Speed is varied by adjustment of calibrated dials, through changes in the input to the grid of thratrons. This static grid control permits infinitely variable speeds from 50 to 6000 rpm.

FORMING HIGH-STRENGTH MATERIALS



By William W. Wood

Manufacturing Research Engineering Dept.
Chance Vought Aircraft, Inc.
Dallas, Texas

Three major factors limit the forming of high-strength aircraft materials. They are elongation, buckling and springback. The author discusses each in turn and shows how they can be overcome by a relatively new process—elevated-temperature creep forming.

HIGH-STRENGTH AIRCRAFT MATERIALS such as titanium alloys give superior performance from a design standpoint but present major fabrication problems. For instance, mechanical properties such as strength and creep resistance are important design considerations. High strength, however, is usually associated with low ductility, restricting formability. Elongation, springback, buckling and distortions all limit the producibility of thin-sheet aircraft parts. Each of these limiting factors will be discussed in turn.

Elevated-temperature creep forming, a new development, *Fig.* 1, eliminates the need for manual operations and solves springback and related problems. Thus, this method can result in lower manufacturing costs and, at the same time, make it possible to form some shapes that were previously unformable except by difficult handworking operations.

Elongation

Elongation has been considered the chief limitation in the forming of aircraft alloys; however, the

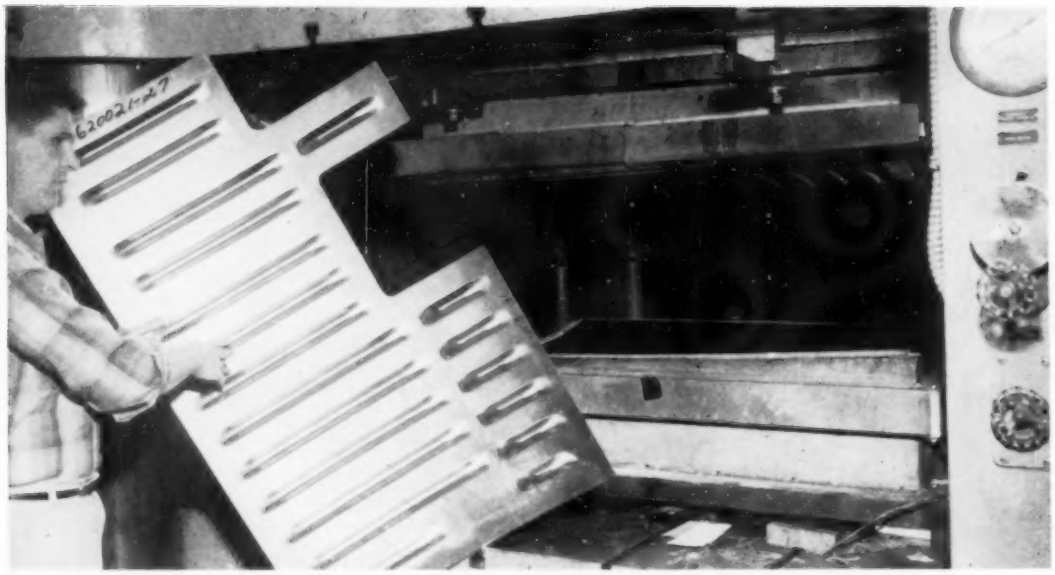


Fig. 1. High-strength titanium part is formed in one operation on a heated die. There is no springback or distortion so no subsequent handworking is required.

importance of this factor has been overemphasized. It is true that elongation is the determining factor in predicting forming limits for parts subjected to fairly severe localized forming, but it is of secondary importance in forming most structural shapes.

For example, elongation is the controlling factor in determining formability limits for bend radii, dimpling, and deep drawing operations, and it is a fairly important factor in determining limits for beading, contour flanging, and recessing. Limits for all of these types of forming have been shown to correlate much better with the true strain, or zero gage length elongation, than with the conventional strain, or uniform elongation. The ultimate failure is always restricted to a very small area because the instability that occurs in a tension test is not evident to a high degree. This is the result of large-strain gradients across the fibers that are being stretched.

The minimum bend radius correlates very well with the ratio ε/S_{TY} where ε is the true strain (reduction in area) and S_{TY} is the tensile yield stress of the material. The higher this ratio is for a material, the lower the minimum bend radius, as shown in *Fig.* 2. Actually, the minimum bend radius is zero for materials whose ratio exceeds 0.058.

Beading, likewise, is closely associated with zero gage length elongation because ultimate failure is always evident in a highly localized area adjacent to the tangent of the bead as shown in *Fig.* 3.

Other less important material properties in beading are the tensile yield stress and the conventional strain. Also shown in the sketch is a typical formability limit graph. Curves of this type have been developed for the ordinary aircraft materials for the particular bead geometry shown.

Contour flanging is partially limited by elongation, but buckling is the principal limitation. Good correlation has been found between splitting and true strain, for instance, in rubber-formed stretch flanges. The relationship for this type of forming was found to be according to the ratio ε/A where ε is the zero gage length elongation of a material and A is a factor depending upon the edge condition of the flange. The factor A is 1.7 for polished edges, 2.2 for deburred edges, 2.8 for machined edges, and 3.3 for sawed edges.

The formability of double-curved skins is only slightly dependent upon elongation. The longitudinal curvature of aircraft is so gradual that, regardless of the transverse curvature, the total elon

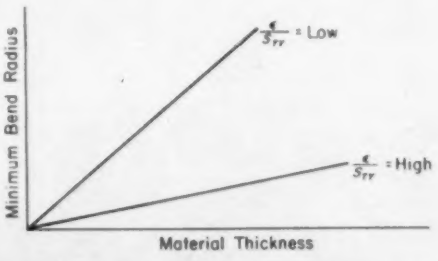


Fig. 2. Minimum bend radius compared for a high ductility and a low ductility alloy.

gation required to shape outside skins is practically negligible. The elongation of most aircraft skins is of the order of 3 to 4 percent; very seldom does the elongation of a skin exceed 10 percent. The principal reason for failure of these parts in forming can be attributed to the operator striving to eliminate springback. This is particularly true in the stretching of high-strength materials.

Elongation, thus, has various roles in the production of aircraft parts. It is the chief limiting parameter for methods that produce severe local strains such as bending, dimpling, and deep drawing while it has about the same importance as buckling for beading operations. Elongation is of secondary importance in predicting formability for contour flanging and it is of negligible importance in predicting formability of double-curved aircraft skins. Wherever elongation is considered, however, the best correlations can be made with the zero gage length strain.

Springback and Buckling

Elongation has little influence on the formability of contoured structural members and double-curved skins. The formability of these parts is limited almost entirely by springback and buckling. Since most aircraft parts are of these types, considerable emphasis will be placed on forming limitations for such parts.

Both springback and buckling can be represented for all materials by the ratio E/S_{TY} where E is Young's modulus and S_{TY} is the tensile yield stress. Springback increases as E decreases and S_{TY} increases as shown in *Fig.* 4. Buckling of thin sheet, whether from direct applied stresses or resulting residual stresses, will also depend upon the ratio E/S_{TY} in the same manner as springback. As E decreases, so will the critical stress that causes buckling. Also, as S_{TY} increases, the forming stress for a given strain increases. Consequently, as E/S_{TY} decreases, both springback and buckling will increase.

Springback and buckling will be evident on all types of parts. They are more prominent on free flanges and large unstiffened parts such as structural members and double curved sheet. Beaded panels and recessed parts have integral stiffening so that springback and buckling are lessened.

Formability of simple structural members such as angle sections by the two basic methods of producing such parts—rubber-press and stretch-press forming—are discussed in THE TOOL ENGINEER, Feb. 1957, page 85 and March 1957, page 105.

Probably 95 percent of contoured, structural, aircraft parts are limited in formability by buckling. The lower the index E/S_{TY} (high-strength materials) the lower will be the formability limits. Springback will also be increased as this index is lowered. Consequently, unless springback and buckling can be controlled, the high-strength materials are difficult to fabricate.

Double-curved skins can be formed in sheet stretch presses, Anderson skin forming machines or in matched mechanical dies. The principal factor controlling formability on a stretch press is springback, while matched mechanical die forming is limited by buckling. The Anderson method has practically no limitations within the geometry of the machine.

Because of the small forming strains and the large radii of curvature of double-curved skins, springback is excessively high when forming high-strength materials on the stretch press. Compensation by die development and handworking is not feasible so that one of the other two methods is the only manner in which the parts can be produced.

The fabrication of beaded panels is controlled about equally by elongation and buckling, as mentioned previously. The buckling of the beaded panel depends primarily upon the material (E/S_{TY}) and

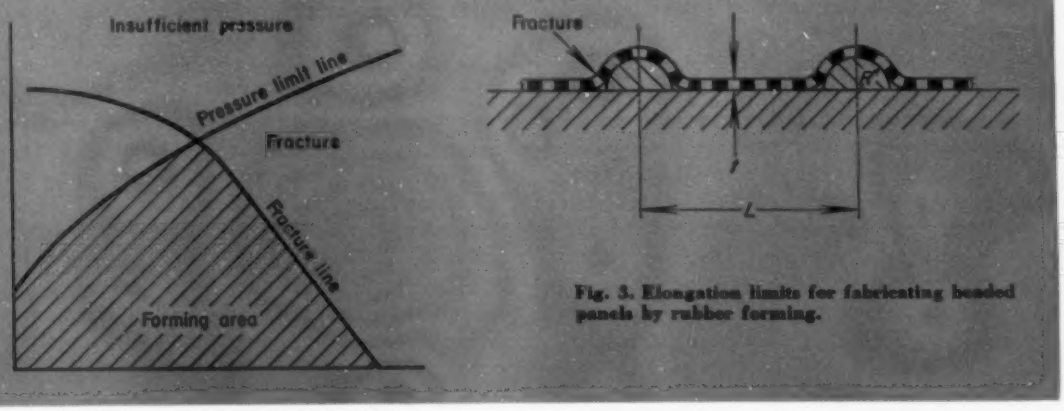


Fig. 3. Elongation limits for fabricating beaded panels by rubber forming.

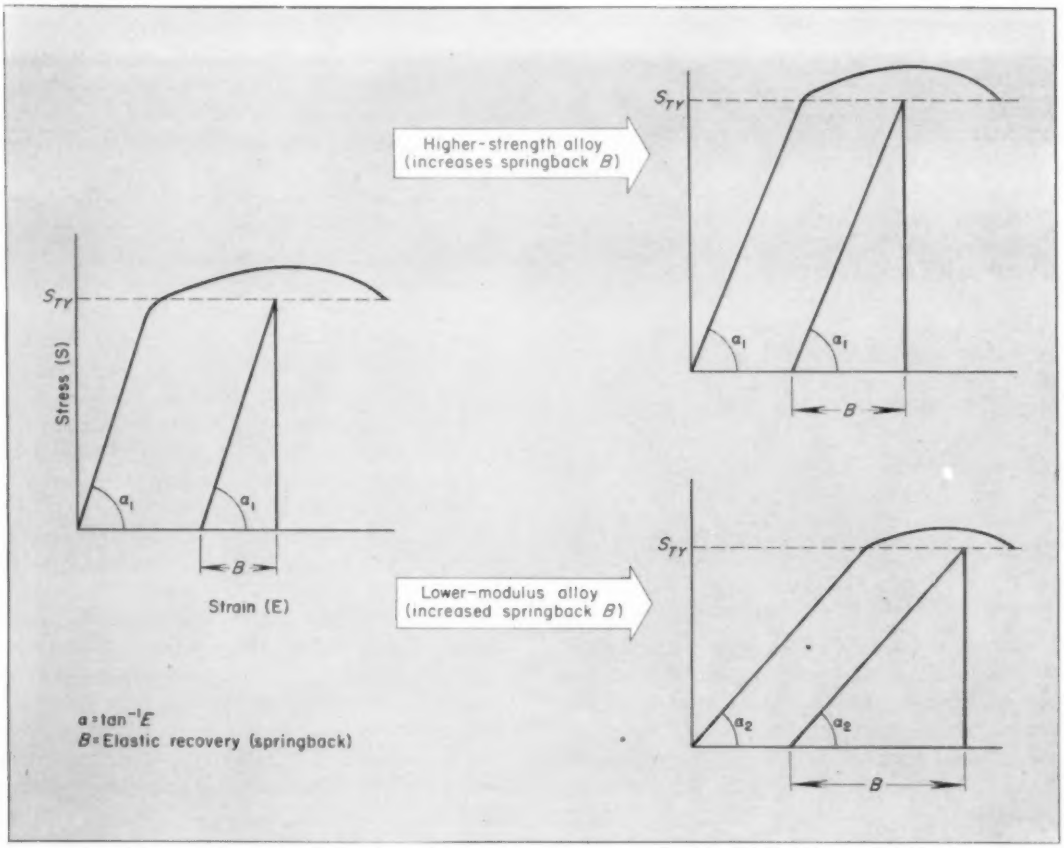


Fig. 4. Stress-strain curve for a typical medium-strength, medium-modulus alloy.

the edge conditions of the panel. Flanged edges increase the residual stresses considerably, resulting in a twist buckling of the part. This buckling is usually negligible for low-strength materials, but the condition cannot be controlled by ordinary means such as handworking for the high-strength materials.

Controlling Springback and Buckling

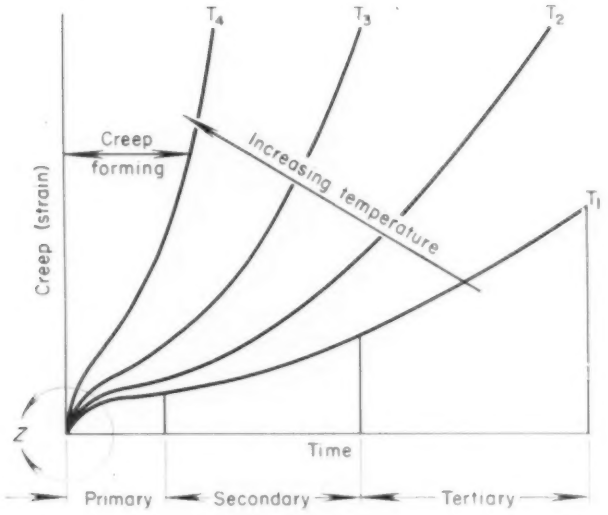
The first efforts at controlling springback were directed toward die development. Dies were shaped so that the part would spring back to the desired shape after it had been formed over the developed die. This method has never proved satisfactory. Material variations such as thickness and strength are sufficient to make die development impossible. The yield strength of 4903 titanium, for instance, varies as much as 45 percent of the minimum guaranteed strength. The complex geometry of most parts makes it practically impossible to isolate the effect that each factor has on springback. Also, normal methods of forming with various operators and machines are so different as to cause considerable variations in springback.

The most popular method of controlling springback is by handworking. This procedure is far from being an ideal production method, but it has been used extensively because no better method has been found. It has been estimated that as much as 50 to 60 percent of the total labor involved in producing part details in aircraft companies is in handworking.

Considerable effort is expended, for instance, on handworking the most widely used material in the aircraft industry, 7075 aluminum. This material is usually formed in the annealed condition. Little difficulty is encountered, but, in most forming operations, some springback is evident. During the quenching operation considerable distortion takes place, while little change takes place during the aging process to the T-6 condition. Whether the part is reformed in the W or T-6 condition, handworking is usually required for final shaping.

Parts such as contoured hat sections and channels with return flanges, double-curved skins, and beaded panels are difficult, if not impossible, to handwork into final shape. Difficult contoured structural members are usually finished-formed with a hammer on a hand straightening fixture.

Another method of controlling springback for specific types of parts is incremental forming. This



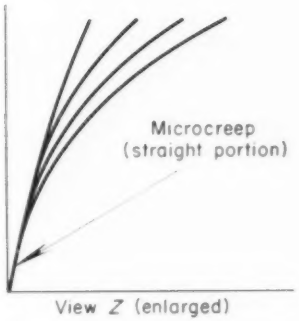


Fig. 5. Typical creep curves for metals. Elevated-temperature creep forming takes place somewhere in the region indicated by arrow at upper left.

method is based upon a localized and progressive plastic deformation. The two principal methods by which this type of forming is accomplished are roll forming and Anderson skin forming.

The former method is limited to forming structural members and sheet into constant-radius curvatures. The types of structural members that can be formed are limited because of the tendency for buckling in the unsupported area. Sheet rolling, on the other hand, has no practical limitations. It is not, unfortunately, a high-production method, as a number of passes are usually required to obtain the correct shape.

The Anderson method is a type of incremental forming for fabricating double-curved sheet. The process can be visualized by drawing a sheet of paper over the round corner of a table. Parts formed in this manner are fairly consistent and springback variations due to material variations are relatively small because of the small curvature of such parts. This is a good production method, but is limited to small curvatures.

A third method of controlling springback is elevated-temperature creep forming. Unlike handworking and the Anderson method, creep forming can be utilized to eliminate buckling and distortions, thus raising the formability limits of a material considerably.

Creep in metals is generally illustrated as shown in *Fig. 5*. The term "creep" is applied to metals where flow is attained at rates slower than slip. Provided the applied stress is sufficiently high, there will be three stages of flow for a given temperature: primary creep, where the flow begins rapidly but later slows down; secondary creep, when the part becomes adjusted to the load and a steady deformation persists; and tertiary creep, evidenced by a rapid increase in flow until failure occurs.

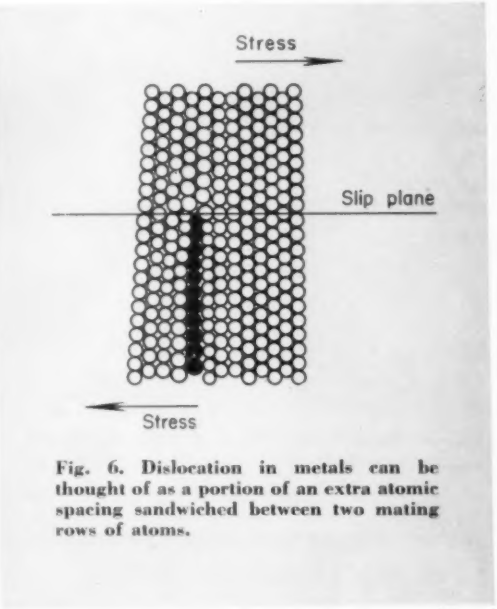


Fig. 6. Dislocation in metals can be thought of as a portion of an extra atomic spacing sandwiched between two mating rows of atoms.

Creep is an obscure phenomenon. One theory relates it to the dislocation theory in metals. A complete description of this theory is beyond the scope of this article; however, a dislocation can be thought of as a portion of an extra atomic spacing sandwiched between two mating rows of atoms as shown in *Fig. 6*. The result is that slip (plastic flow) along the slip plane is much easier than would be the case if no dislocations were present.

Creep in metals is thus dependent upon the level of the applied stress, time, temperature, and the number of dislocations present. In elevated-temperature creep forming, the applied stresses are generally low and the forming time is usually less than

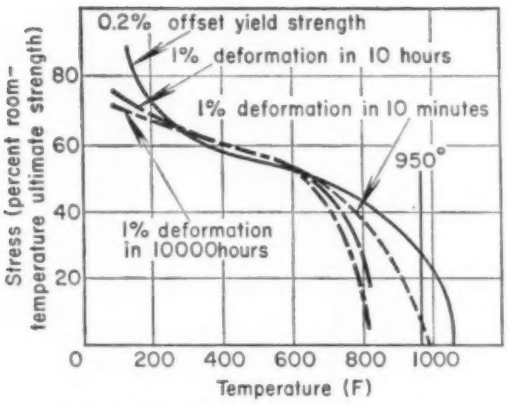


Fig. 7. Creep properties plotted against temperature for Rem-Cru C-110M annealed sheet.

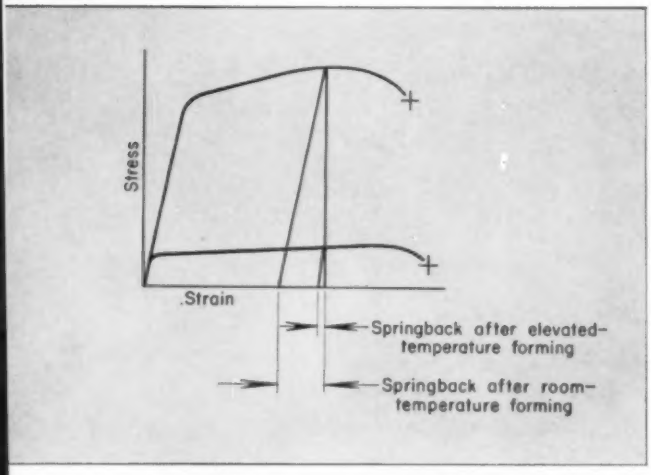


Fig. 8. There is comparatively little springback of metals after elevated-temperature creep forming.

Temperatures to Produce Permanent Creep

Material	Temperature (deg F)
6Al. -4V titanium (annealed)	1200
HK31-H24 magnesium-thorium	650
17-7 PH steel (fully aged)	1050*
2024-T81 (fully aged)	650

*Only about 50 percent susceptible at this temperature.

10 minutes. The number of dislocations is dependent upon the alloy and, consequently, the susceptibility for elevated-temperature creep forming is dependent upon the material.

Temperature acts to increase the thermal fluctuations of the atoms (kinetic energy gain) resulting in the necessary activation energy for generating new dislocations. Under a constant load, as in a hot mechanical forming die, microcreep is initiated by dislocations already present in the material; however, the material is allowed to creep further by the additional dislocations formed by the thermal energy. Finally, equilibrium is reached after sufficient strain has occurred to relieve the applied stress to a negligible quantity.

What proportion of the total strain occurring in elevated-temperature creep forming can be attributed to microcreep and what proportion can be attributed to secondary creep is unknown. At any rate, the amount of recoverable creep is negligible provided the temperature and time are sufficient. Permanent deformation has been found to occur on AMS 4908 titanium in 6 to 10 minutes at 950 F. Temperatures that have been tentatively found to produce permanent creep in other materials are shown in the accompanying table.

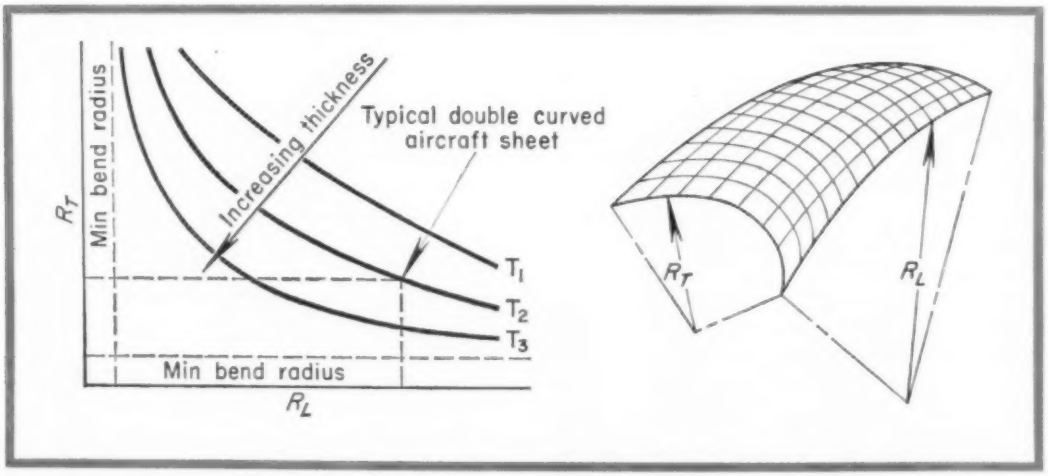


Fig. 9. Limitations of double-curved skin forming in a mechanical die from a flat blank. Typical double-curved aircraft sheet has large longitudinal radii and relatively small transverse radii.

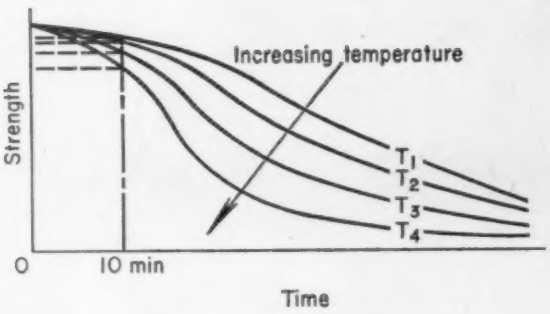


Fig. 10. Short-time room-temperature strength after short-time exposure of an alloy to elevated temperatures.

This type of creep forming can be visualized with the aid of a stress-temperature diagram as shown in *Fig.* 7. The curves represent the relative amount of stress necessary to produce 1 percent deformation in 1000 hours, 1 percent deformation in 10 hours, and 1 percent deformation in 10 minutes (estimated). It should be noted that only around 5 percent of the room temperature ultimate stress is needed to produce 1 percent deformation in 10 minutes at 950 F. This is strictly an estimate, but it presents a qualitative picture of what is necessary to produce elevated temperature creep forming.

The sketch shown in *Fig.* 8 illustrates the disappearance of springback when parts are formed at high temperatures. The upper curve represents a room temperature stress-strain curve resulting in an elastic recovery or springback provided forming is at room temperature. The lower curve illustrates the low stress level approached in elevated-temperature creep forming, resulting in negligible springback.

Elevated-temperature creep forming can have many applications such as: (1) contoured structural members; (2) beaded panels; (3) double-curved sheet; and (4) recessed parts. Other types, such as deep drawn parts are excluded because elevated-temperature creep forming is intended primarily as a means of removing springback and distortions rather than increasing elongation.

The principal applications at Chance Vought have been on forming AMS 4908 and 4901 titanium structural members. The benefits to tooling and production have been considerable. Practically all handworking that would normally be necessary to obtain the desired shape has been eliminated. Future investigations will be concentrated primarily on beaded panels, double-curved skins, and recessed parts.

Creep forming, in general, increases formability around six to ten fold; however, there are still limitations of the same sort as in conventional forming. For instance, the formability of most structural members is limited by shrink flange type curves. Beaded panel formability is limited to the type of curves shown in *Fig.* 4; however, the curves will be transferred to a much more favorable position at the upper right side of the graph.

Double-curved skin forming is expected to be limited according to the graph shown in *Fig.* 9. Buckling is still the limiting parameter as indicated by improvement in formability with increasing material thickness. A typical double curved aircraft sheet with a large longitudinal radius and a small transverse radius is shown as a dot on the graph.

Finally, limitations to elevated-temperature creep forming are associated with the metallurgy of the material. The consideration here is what effect temperature exposure has on mechanical properties. A typical graph representing this effect is shown in *Fig.* 10.

It can be seen that the loss in strength for this material after an exposure of 10 minutes for the two temperatures T_1 and T_2 is not appreciable; the higher temperature T_3 and T_4 result in a somewhat higher loss in strength. Another metallurgical consideration is age embrittlement, although the sensitivity of most materials in this respect is not very high for such short exposure times.

In the future, elevated-temperature creep forming will be the chief method of controlling springback and distortion in high-strength aircraft materials. From a manufacturing standpoint, the susceptibility of an alloy to this type of hot forming will be the principal criterion for the selection of materials for airframes. If the temperature required for creep forming is beyond the practical metallurgical limits for a material, it is doubtful that manufacturing would advocate its acceptance for use.

Creep forming can be applied to most parts where mated dies can be utilized for forming. The principal modes of heating have been with electrical resistance heated cartridges inserted in mechanical dies. Heating in the future might possibly utilize a means such as hot fluid so that die costs could be reduced to approximately half of the current costs.

interferometer checks gage-block accuracy

Fig. 1. Interferometer developed at the Bureau of Standards for measuring parallelism of gage blocks. The instrument is direct reading making it fast and convenient to use.

More rapid and convenient measurement of the parallelism of opposite gage-block faces is made possible by an interferometer developed at the National Bureau of Standards. The instrument is adjusted by a few simple controls, and angle between gage block surfaces is read directly on a calibrated scale.

FOR A GROWING NUMBER OF PROCESSES such as manufacture of machine tools, ball bearing and missile control systems, test gages for dimensional control must be accurate to within 0.00001 inch. The gage blocks for checking the accuracy of the gages must be even more accurate. Interferometers permit measurement of gage blocks with errors of less than a small fraction of a wave length of the light used.

Interferometer Operation: Basically the principle of interferometer operation is the reinforcement or cancellation of reflected light rays. If two light rays from the same source travel along different paths and are then reflected to a common point, a difference in length of the respective light paths will cause the light waves to be out of phase with respect to each other. The difference in length of optical paths causes these rays either to reinforce or cancel out each other. When a light beam, or collection of parallel rays, is reflected as described, a pattern of interference fringes is formed. These interference fringes are alternating bands of light and darkness formed by reinforcing and cancellation of light rays. The spacing of the fringes depends on the difference in optical path length of rays in adjacent bands. In usual interferometer operation, the two beams are reflected from different surfaces, so that the fringes give information about the relative position of the two surfaces.

In previous applications of interference measurement of gage-block parallelism, the procedure has been to wring the block onto an optically flat surface and to measure the angle between the upper surface of the block and the exposed portion of the optical flat. The wringing involves contact with

the hand, which raises the block's temperature and may entail a long wait for temperature equilibrium to be established.

A New Method: An instrument developed by the National Bureau of Standards, *Fig.* 1, avoids both of these difficulties by measuring the angle between the opposite faces of the block by a direct comparison of the two faces. Although its optical arrangement is more complex than former types, preliminary tests show not only that it can be operated more easily, but that the operating procedure can be reduced to a simple routine.

Principal Components: The principle optical components are a double-image Kösters prism and a right-angle prism, *Fig.* 2. The double-image prism is made by taking two 30-60-90 degree prisms, depositing a semitransparent layer of aluminum on a face of one of them, and cementing the two together with the aluminized face on the inside. The resulting unit is a 60-60-60 degree prism which is "split" down the middle by the semitransparent layer. The right-angle prism is used for its property that a ray of light entering through the base (face opposite right angle) along any line perpendicular to the 90 degree edge will emerge, after two internal reflections, along a path exactly parallel (and opposite) to its original direction.

The double-image prism is mounted with its base (face bisected by the aluminum film) downward and horizontal; and the right-angle prism is about a foot directly below with its base upward and its 90-degree edge in the transverse plane. The central plane contains the aluminized layer. The transverse plane is perpendicular to the central plane and passes through the center of the double-image prism. The gage-block to be measured is supported on a perforated plate between the two prisms. It is placed to one side of the transverse plane and so that its upper and lower surfaces (the angle between which is to be measured) are approximately horizontal and are bisected by the central plane.

Light from a point source is collimated into a parallel beam, the collimator axis being normal to one of the upper surfaces of the double-image prism. A viewing tube, containing an objective lens and a micrometer eyepiece, has its axis normal to the other upper surface.

Operation: The parallel beam from the collimator passes through the double-image prism, *Fig.* 3, to the semitransparent layer, where each of its rays is divided into two parts; one continues ahead to the opposite face and is internally reflected straight downward; the other part is bent back to the face through which it entered and is there reflected downward. The two emerging rays (which are derived from a single original ray) are symmetrical with respect to the central plane.

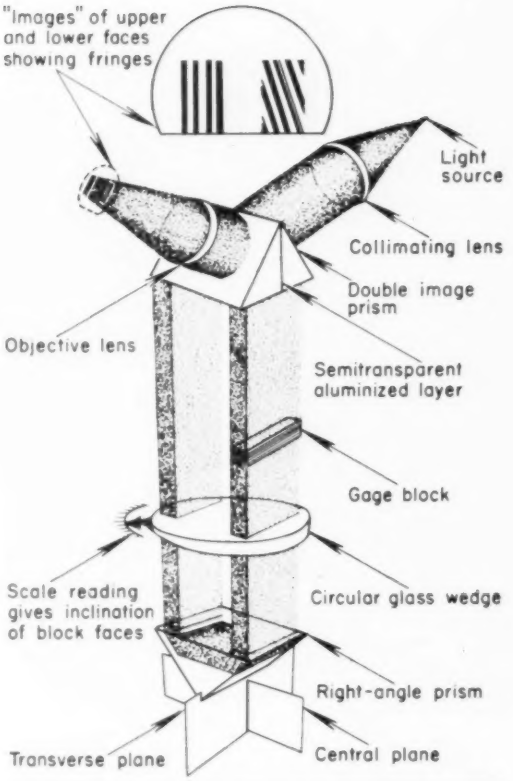


Fig. 2. Pictorial diagram of interferometer. The light from the collimator is split into two beams by the semitransparent layer, and parts of both beams strike the upper face of the block. At the same time, parts of both beams reach the lower face of the block by way of the right-angle prism. If this face is parallel to the upper one, a set of fringes parallel to those of the upper face is seen. If the faces are inclined, the fringes from the lower face are rotated as shown.

Some of the rays on one side of the transverse plane strike the top surface of the gage block and are reflected back to the prism. If the surface is perpendicular to the rays, both members of a symmetrical pair are reflected back along their paths to the semitransparent surface. Here each ray is again split, and half of one combines with half of the other to emerge along the same line toward the viewing tube.

Rays on the other side of the transverse plane follow a similar path except that these pass through the right-angle prism and emerge vertically upward. Some of these strike the lower surface of the gage block. If this is perpendicular to the rays, a given symmetrical pair will be reflected back along their

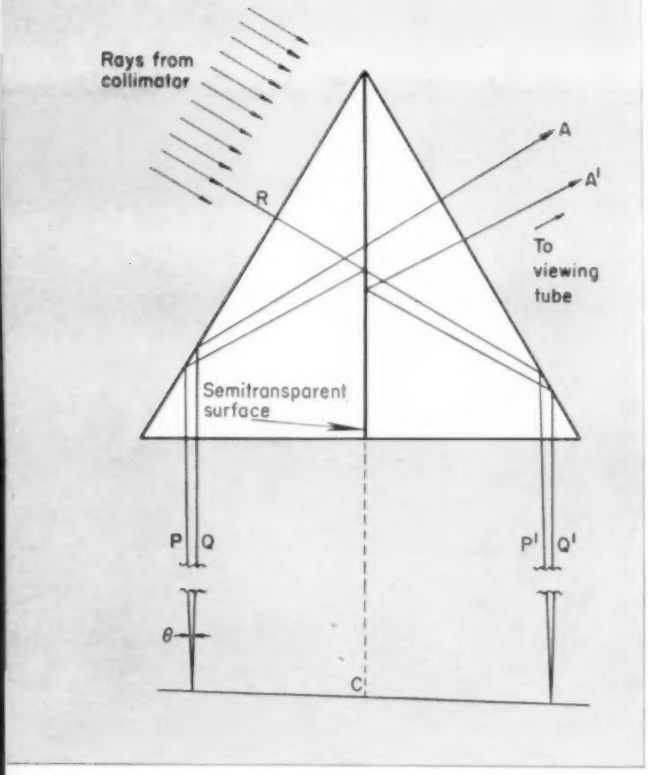


Fig. 3. Diagram to illustrate the formation of interference fringes. A ray, *R*, enters the double-image prism and is split into two components at the semitransparent surface. After internal reflection, the two rays emerge along symmetrical paths *P* and *P'*. The rays return along *Q* and *Q'* and emerge in the directions *A* and *A'*.

paths and, by the process described, combine to form a single ray moving toward the viewing tube.

Rays that do not strike the gage block are internally reflected in the right-angle prism, each ray of a pair moving up along the path by which the symmetrical ray had descended. As before, the two rays are recombined at the aluminized surface and proceed to the viewing tube, where they form the background of the field of view.

The two halves of the double-image prism are twisted slightly to produce a permanent set of fringes. Through the eyepiece, two separate interference patterns are observed, one for each of the gage-block surfaces being compared. Each pattern is formed by the interference of light rays reflected from different parts of the same surface. If the two block surfaces are parallel, the fringe patterns are also parallel; otherwise the two sets of fringes are inclined by an amount that depends on the angle between the surfaces. By placing a glass wedge in the path of the rays and rotating it to the correct position, the fringe patterns may be made parallel. The glass wedge alters the path of the light reflected from the bottom surface of the gage block so it corresponds in angular direction to that reflected from the upper surface. The angle between the two surfaces can then be read directly from a suitably calibrated scale attached to the wedge.

The instrument measures only one component of inclination at a time; that is, the part of the inclination that corresponds to rotation about the line which is formed by the intersection of the surface and the central plane. To measure the other components, the block is rotated 90 degrees.

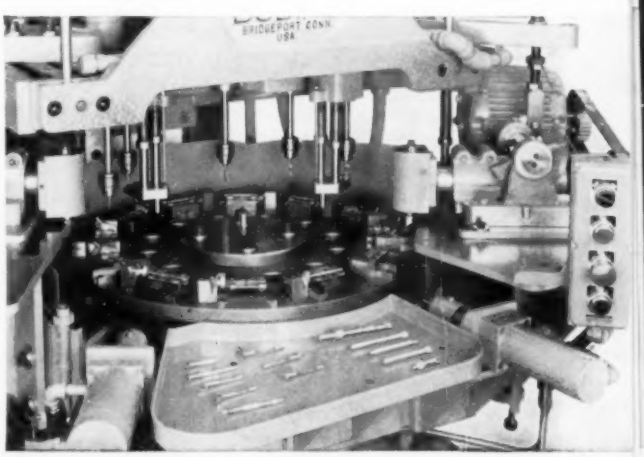
Use of the interferometer is expected to improve efficiency of gage-block calibration in a wide range of industries where the blocks serve as reference standards for high-precision manufacturing.

Basic Tooling Solves Variable Job

A TROUBLESOME tooling riddle dogs manufacturers who make a comprehensive line of products and cannot avoid size or design variations. In such cases, basic design of the part remains unchanged, but there are multiple variations in size, location of machined surfaces, spacing of holes, etc.

On a specific carburetor job, a manufacturer solved his problem by combining six operations on each shaft on a single Bodine automatic machine. An ingenious arrangement of workholding devices, plus rapid changeover, allows 14 variations to be handled on the same machine with the same basic tooling.

Production of the brass parts is at a rate of 550 pieces per 50-minute hour with the machine operating at 11 strokes per minute.



EQUIPMENT LEASING

...conserves working capital

By Clarence C. Kane
Vice President
United States Leasing Corp.
San Francisco, Calif.

Finding new sources of funds to keep a company operating competitively is a common problem. The author explains how leasing of new equipment offers one way of extending working capital.

LEASING OF EQUIPMENT makes it possible to remain competitive without heavy capital investment. While leasing is not an infallible solution to all the financial problems of an organization, many companies have found it advantageous to lease, rather than purchase, new machines and equipment.

The leasing process begins when the manufacturer determines his process equipment and machine requirements. Some equipment manufacturers do not lease their equipment—they either sell it outright or on conditional sales contract. Other manufacturers will lease their equipment but, if the lessee wants to lease items from different manufacturers, he has the problem of coordinating leases from different companies. Here the leasing company is useful. It will make any equipment available on lease, from any manufacturer, and combine all the equipment on one lease. All the lessee has to do is determine what equipment he wants, from what supplier he wants to receive it, and the length of the lease desired.

Leases may be written on straight line, declining balances, sum of digits, or any other plan to suit the lessee's requirements. Payments may be from one to 10 years, and normally renewal options are available for extended periods.

The total cost of a lease is the original cost of the facility or equipment, plus a leasing charge for the term of the lease. Since only the lease payments due within twelve months appear as a liability on the financial statement, the ratio of current assets to current debts, as well as the ratio of net worth to total debt are affected very little.

The simplest method by which a manufacurer can acquire new equipment is, of course, to purchase it out of his working capital. Yet, despite the fact that this method is simpler, some manufacturers prefer to lease. The reason for this preference lies in the relative cost figures. For example, if a manufacturer takes $10,000 out of his working capital and uses it to purchase new equipment, some payment must be made for the use of that money. Every dollar of working capital has earning power and an investment of the $10,000 in new equipment must return to the company at least the same amount of profit that could be earned by investment of a like amount in other ways.

The typical manufacturer earns 15.85 percent net

profit on working capital, according to a recent survey. The figure refers to profits after taxes. Since all the corporations surveyed were in the 52 percent bracket, the profit before taxes on net working capital was about 33 percent.

This condition presents the manufacturer with a problem. If working capital is used to buy new equipment, and the funds earn 33 percent before taxes, then 33 percent interest is being paid for the use of the money tied up in the equipment.

It is important, therefore, that a manufacturer examine his earnings ratios to see how often his working capital turns over. Direct costs of the investment of working capital in the proposed equipment must be determined. If outside financing through leasing can be acquired at less cost than the use of the company working capital, this is the path to follow. If not, it is sounder to buy.

In general, leasing is most beneficial for companies whose operations could expand profitably if additional working capital, in the form of equipment and machinery, were available. Actually, the advantage of the lease arrangement lies in the way it frees dollars, otherwise invested in ownership of fixed assets, for more profitable uses. In some special situations, leasing does offer a tax advantage, but few companies are in these circumstances.

The simplest method by which a manufacturer can acquire new equipment is to purchase it out of his working capital.

In general, leasing is most beneficial for companies whose operations could expand profitably if additional working capital were available.

Other possible advantages of leasing are realized in special situations. Companies wishing to convert fixed assets into current assets may sell the asset and immediately lease it back. Another condition that may make leasing desirable is the need for cost reduction. Here acquisition of new machinery is a must, but financial conditions may not permit purchase or even borrowing to make a purchase. Under such conditions leasing is the best answer.

Still other companies hold a tight rein on capital expenditures, although the officers may feel it mandatory that certain new equipment or facilities be installed. Even if equipment is purchased on a credit plan, it decreases the ability of the concern to borrow in other directions. Leasing of a fixed asset has a similar effect, but only to the smaller extent of the annual rental.

The possibility of rapid obsolescence presents a problem that many companies fear when faced with a large investment for new equipment. Leasing bypasses this problem of a large investment and permits the user to acquire the latest and best equipment on a short-term lease.

For many years, corporations have thought nothing of renting real property, but insisted on purchasing machinery and equipment. Due to inflationary pressures, industrial real estate has not only held its value, but has actually enhanced. Machinery and equipment must always depreciate in value as the equipment wears out. If a corporation expects to expend $2,000,000 on plant and a like amount on equipment, that company might be wiser to own its real estate and lease the equipment. Many corporations are finding that inflation has caused a readjustment of thinking as to which fixed assets should be purchased and which leased.

In the final anlysis, the desire to maintain business liquidity by freeing more working capital has led many companies to lease instead of buy. In the industrial machinery manufacturing field, the ratio of quick assets to current liabilities dropped from 3.15 in the middle of 1954 to 2.80 in the middle of 1957. This decline of liquidity is in part due to the impact of federal tax legislation providing for a speed-up of corporate tax payments. In part, it is due to the greater demand for credit by business customers. The result is that many manufacturers have turned to leasing to conserve working capital.

Manufacturers who wish to free capital for expansion of sales, for obtaining trade discounts, for building balanced inventories, for expanding research and development—for all the customary uses of working capital—should check the possibilities of equipment leasing.

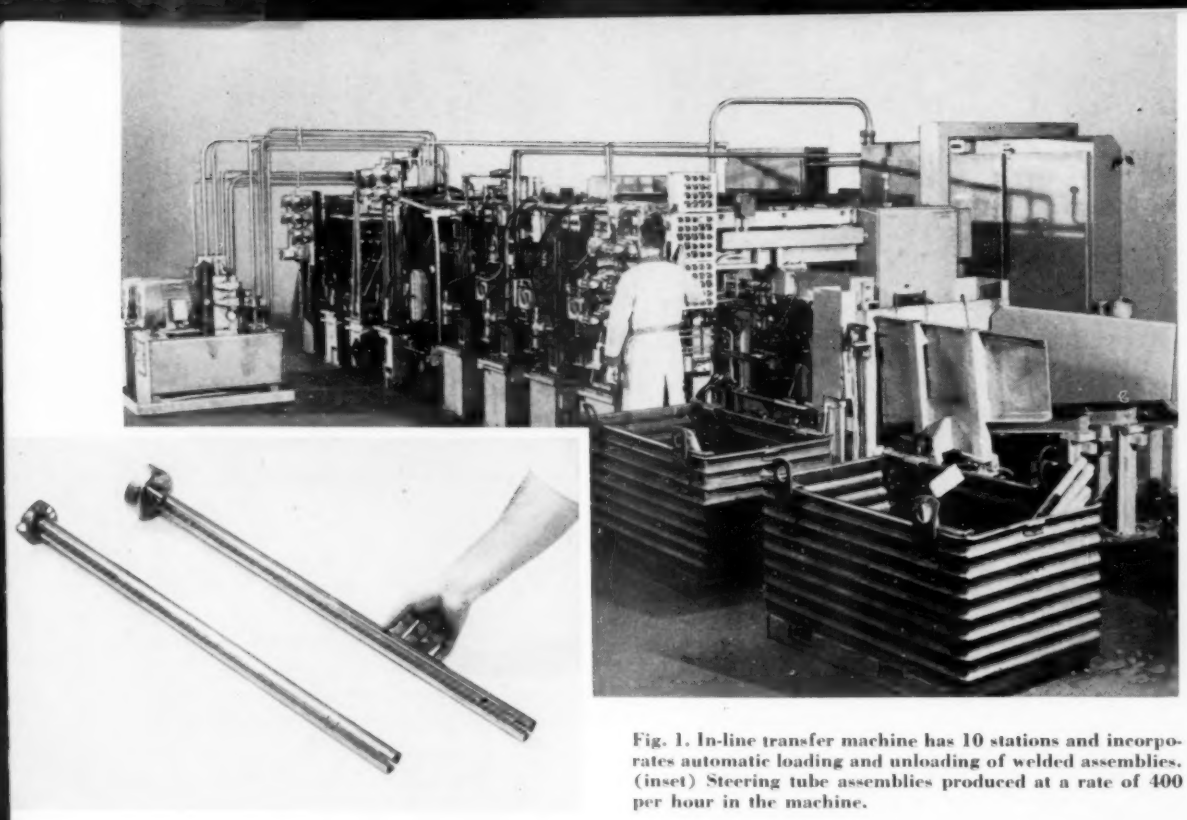


Fig. 1. In-line transfer machine has 10 stations and incorporates automatic loading and unloading of welded assemblies. (inset) Steering tube assemblies produced at a rate of 400 per hour in the machine.

COSTS REDUCED — by integrating welding and machining

By J. H. Brems
Project Engineer
Welding Machine Div.
Expert Die and Tool Co., Inc.
Detroit, Mich.

Application of automation principles to welding has increased production and quality of many parts. Typical examples of parts processed by these techniques are discussed in this article with emphasis on equipment requirements.

Abstracted from paper 127, "Application of Weldamation Techniques to Welding Processes," presented at the 26th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

COMBINATION OF WELDING PROCESSES with other operations such as metal removing, forming, heating and assembling into one integrated line has distinct production advantages. In an integrated line, these two families of part processing techniques complement each other. When properly applied, cost reductions are achieved by reducing manpower requirements, increasing production, reducing floor space and providing quality parts.

Automation usually involves many machining or assembly operations but has not generally incorporated the welding process. The addition of welding to an automated line may result in simplification of the over-all processing. As a logical extension of automation, this addition may be termed "weldamation."

Typical Weldamation Machines

The 10-station in-line machine shown in *Fig.* 1 produces 400 finished steering tube assemblies per

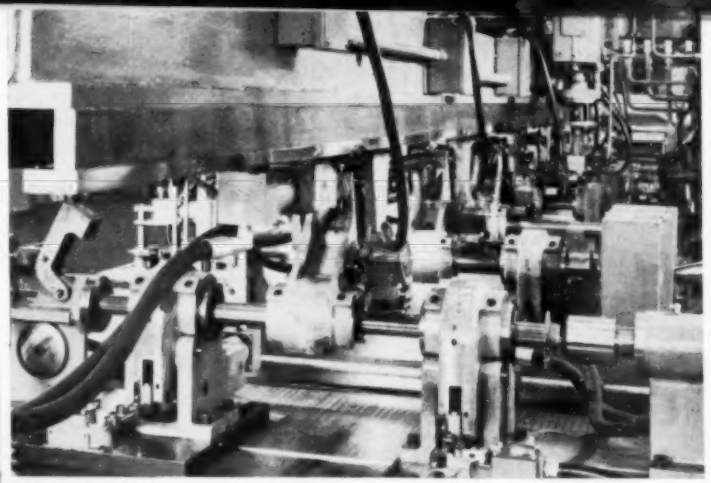
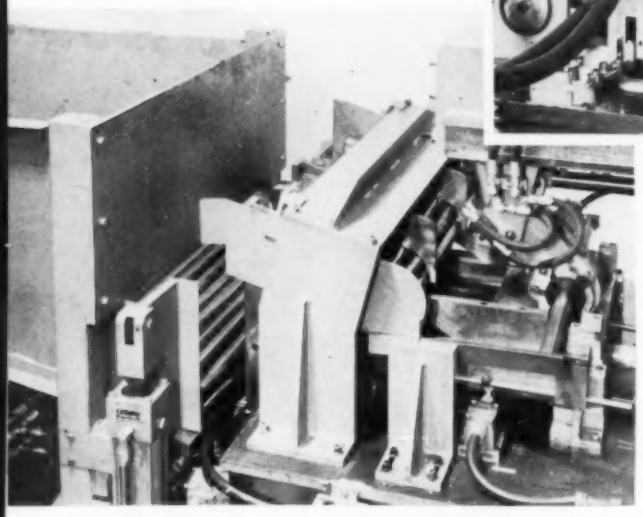


Fig. 3. The transfer mechanism consists of a reciprocating transfer bar containing 10 clamping fingers.

Fig. 2. (below) Automatic loading mechanism of the steering tube weldamation machine.



hour. This machine automatically loads tubes to the transfer system, assembles and welds a flange to one of the tube ends. Eight machining operations are performed on the tube end, followed by a test of the finished assembly.

To begin automatic loading operations, tubes are placed in the hopper in bundles. An air-powered lifter plate, *Fig.* 2, transfers the tubes upward to an inclined feed magazine where they slide, one at a time, into a reciprocating grooved shuttle plate. This shuttle plate transfers the tubes to the transfer bar mechanism.

The transfer mechanism, *Fig.* 3, employs a longitudinally reciprocating bar containing 10 clamping fingers. Parts are transferred from station to station in an inverted U-path by the reciprocating clamping fingers. The bar and each clamping finger is separately operated by a hydraulic cylinder.

Automatic assembly, welding, machining and testing operations begin when a flange is manually loaded into a feed track at the first station, *Fig.* 4. The flange is orientated and assembled, by hydraulic press, to one end of the tube. Location and orientation of the assembly is maintained during transfer to the second station where the flange is spot welded to the tube. The assembly is then relocated axially in station three prior to clamping and four slots are pierced in one end of the tube while a second spot welding operation is performed on the flange. The tube is again relocated radially in station four before the part is clamped in the fixture. A hole is drilled near one end of the tube and a third spot welding operation is performed on the flange end. The flange end of the tube is reamed in station five to remove any build-up caused by spot welding.

In the next three stations, a key is formed in one end of the tube. Three stations are required for this operation because of the size of the slot. The assembly is transferred to the ninth station where the weld is tested by axial pressure exerted on the flange. If the weld is satisfactory, the tube is marked with a steel stamp. Assemblies are deposited on conveyor at station ten.

Stations that were added to this machine after completion are shown in the shaded area indicated in *Fig.* 4. After the machine was in production, a part design change necessitated the additions of these three stations. Since the machine was designed with modular construction, the station additions were made at minimum cost. If the machine had not originally been so designed, the cost of adding the extra stations would have been considerably higher.

Adjustments are provided on the machine to permit the handling of two different tube and flange components. Thus, by allowing for a short duration change-over period, the machine can produce two different assemblies.

Another typical machine that incorporates welding with other operations is a 10-station in-line weldamation machine, *Fig.* 5. It assembles two carbon steel transmission parts (disk and hub), preheats and welds the assembled parts and heat treats the welded assembly in one continuous operation. Production rate of this machine is 180 assemblies per hour.

The weldamation machine shown in *Fig.* 6 utilizes automation concepts to combine a short cycle press assembly operation with a relatively long cycle argon shielded-arc welding operation to produce

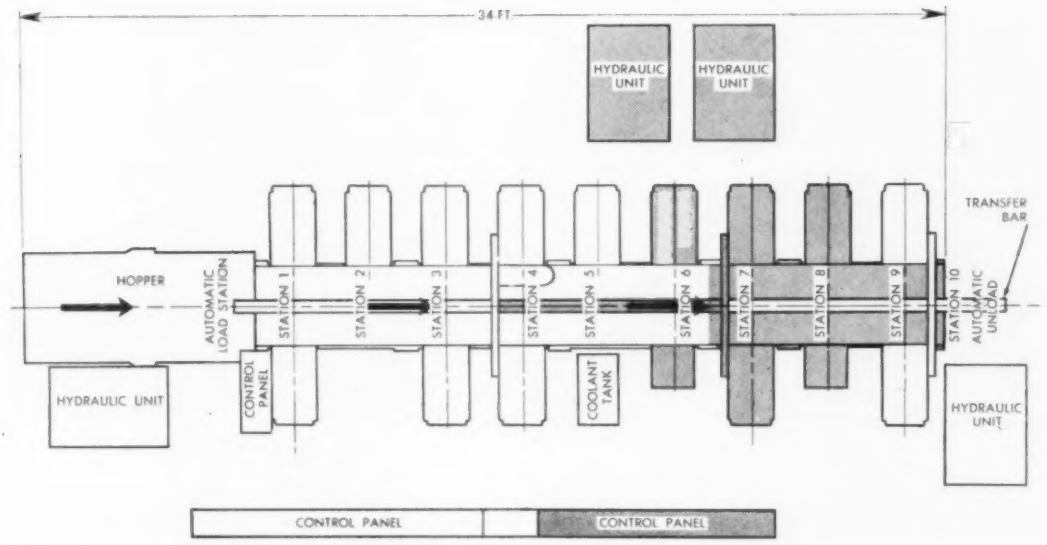


Fig. 4. Plan view of the modular construction for weldamation machine. Additional stations shown by shaded area were necessitated because of a part design change, which caused processing to change.

240 fluid coupling parts per hour. This machine consists of a vertical hydraulic assembly press, three standard welding heads positioned at 90-degree locations around the press and three hydraulically controlled pivoting fixtures. Parts to be welded are manually loaded on one of the pivoted fixtures resting on the press platen. The press ram travels downward pressing the two parts together. After the press ram returns to top position, the fixture pivots out of the press at a 45-degree angle to the welding station. The pressed assembly and fixture then rotate as a unit at a speed of 90 ipm while the welding heads join the parts. As one fixture pivots out of the press station, the fixture containing a finished welded assembly pivots into the press station where the assembly is manually removed and the fixture again loaded for the assembly operation.

Advantages of Weldamation

The advantages of automation apply also to weldamation with some shift in emplasis. Compared with general-purpose machines, equipment combining welding and machining can reduce the final cost of a workpiece. The reduction in cost is a composite of savings in manpower, floor space and materials handling. These savings are partially offset by higher machine costs and relative lack of flexibility when compared to general-application machine tools and welding machines.

Additional cost savings may result from a revised method of manufacture. For example, a manufacturer of internal gears was able to reduce manufacturing costs by first broaching the gear tooth in a tubular blank and then welding the hub and flange components together in a weldamation machine. The machine automatically press assembles the hub and flange. It then preheats, welds and ejects the finished assembly from the machine. Previously, this part was made by shaping from a forging. This example points out the requirement for awareness on the part of the designer and processing engineer to consider weldamation as a key to lower cost manufacturing processes.

An application illustrates how a part previously produced by one method was easily adapted to weldamation with resultant production savings. In

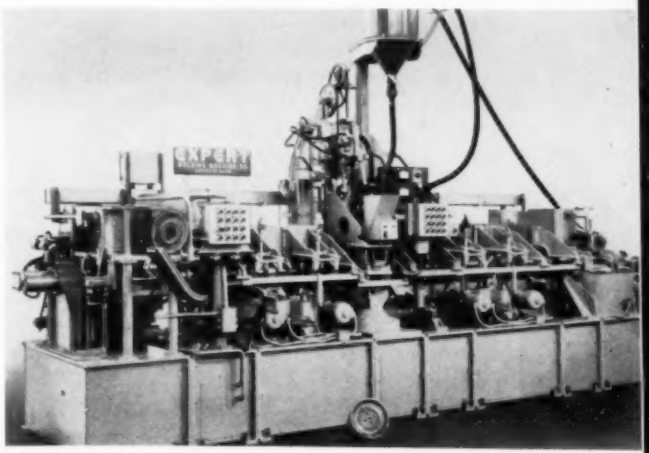


Fig. 5. In-line weldamation machine assembles two steel transmission parts. It preheats, welds and heat treats the assembly in one continuous operation.

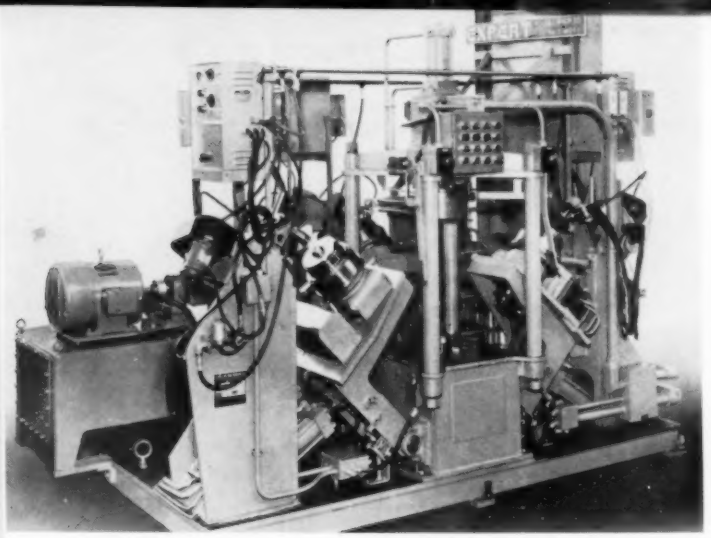
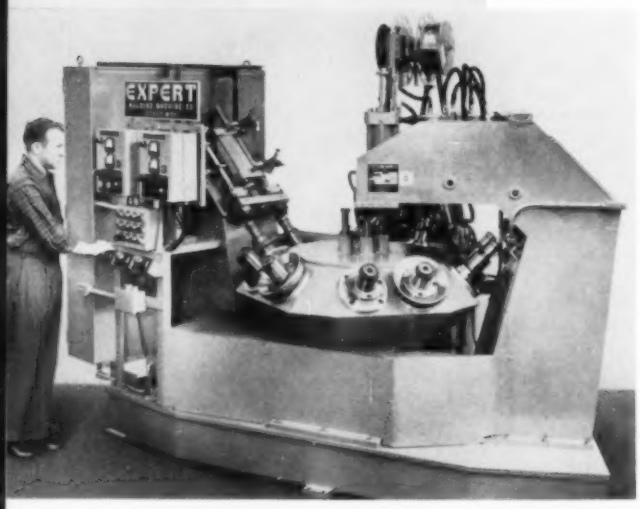


Fig. 6. Weldamation machine combines press assembly operations with argon shielded-arc welding operations to produce fluid coupling parts.

Fig. 7. (below) Five-station rotary index machine assembles and welds a flat circular plate to the inside of a cylindrical component to form a can assembly.



the original process, a trunnion type welder and three presses were used to produce the finished welded and machined assemblies with four men required to operate the machines. By adopting the weldamation concept, only one machine and one operator is required to produce a completely welded and machined part with all operations performed without interruption. In addition, the weldamation production rate was 11 percent higher on the welding operation and 27 percent higher on the machining operations.

One manufacturer faced with the problem of selecting a fabrication process to produce a "can type" assembly found the top practical methods were drawing and weldamation. Weldamation was selected because the fabrication costs up to the point of welding were sufficiently lowered to more than offset the additional cost of automatic assembly and welding. The machine now producing the assembly is a 5-station rotary index machine that combines assembly operations with welding operations to produce 500 assemblies per hour. *Fig.* 7.

Another advantage of weldamation includes the ability to weld alloys which require preheat, postheat or both to achieve a satisfactory weld. Generally, it is not practical to perform all of these operations in one weld station. Therefore, a transfer machine of one of the many available types is used. The assembly is heated to a predetermined temperature by flame or induction heating in one station, and transferred to the weld station before the part has cooled. After the weld has been completed, the assembly is moved to the postheat station where additional heat is applied to the assembly to minimize cracking tendencies in the weld. This type of welding it practical as a production process only on a welding transfer machine.

An increase in part quality may be achieved by a properly designed welding machine tool. The consistency and quality in a well-designed weldamation machine has opened the way for application to gears, transmission parts and many other precision components.

Weldamation Techniques

These machines may be in-line transfer, rotary index, trunnion, center column, or in-line and rotary index combination. The choice of which type to use is dependent upon the factors for each specific application. As a generalization, these factors govern the machine type choice in an automation machine, except that several new conditions exist in weldamation equipment not ordinarily found in automation equipment. Fixturing is required to hold a family of loose pieces together, in proper relationship to one another during welding. Another is the consideration which must be given to flux and splatter removal or disposition. Each of these factors exerts its influence on the choice of a given machine type and, more important, determines the detail construction within a given machine.

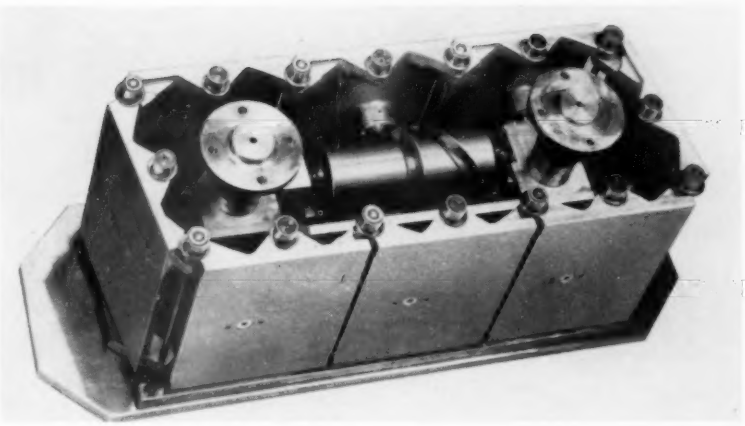


Fig. 8. Model of typical over-and-under transfer mechanism. The pallet driving mechanism consists of a cam index mechanism, with the pallets connected to form a closed loop.

In-line transfer machines have the part or assembly loaded in a fixture and the parts or fixtured parts are transferred in a straight line from station to station. The load and unload operations may be either automatic or manual operations depending upon the degree of automation required. With this type of machine, the ultimate in weldamation concepts can be achieved as the maximum number of production operations can be performed in a given floor area at maximum production rates.

Any number of weldamation operations can be performed on in-line transfer machines because part turnover and orienting devices can be incorporated into a machine at almost any point. With this type of machine, weldamation operations can be performed on both ends of the part. This adds flexibility to the machine for producing complete assemblies.

The over-and-under transfer mechanism, *Fig.* 8, is used where parts are clamped in fixtures or on pallets for transfer from station to station. It is useful for parts having a shape that is difficult or impossible to handle with transfer beam mechanisms or where the assembly remains fixtured from one station to the next. This type of transfer mechanism is more expensive than transfer bar types.

All fixtures or pallets on the over and under transfer mechanisms are pivot-connected, so that the pallets themselves form a closed loop. Each pallet is supported by hardened rollers in a hardened track for both forward and return flights.

The guiding tracks at the end of the loop where the fixtures turn over and return are designed to provide a continuous, smooth and uninterrupted turnover without the use of sprockets. The pallet driving mechanism consists of a cam index mechanism.

In-line transfer weldamation machines are usually designed and built with modular construction. With this concept, the machine is constructed with separate or individual welding and machining units each having individual bases. The only connection between the units is the transfer bar. This method of construction provides the best flexible design for allowing station addition or subtraction from the machine to meet any possible future part design changes.

High production rates in a compact floor space are achieved with the rotary index weldamation machine. In this type of machine, parts are mounted in fixtures on a horizontal table and indexed from station to station. The stations are usually equipped with radial, horizontal or vertical welding, assembly and machining units. To achieve maximum production from a machine of this type, more than one operation can be performed on the part in one station. In many instances, two stage fixtures can be used in which two parts are clamped in one fixture in different positions to permit different operations to be performed on the pair of parts at the same time. This technique often permits one machine to do the work normally requiring two or more machines.

A trunnion type machine consists of a vertical table with several fixtures mounted on the table. The table is indexed from station to station where operations are performed simultaneously on the part and a finished part is produced with each complete index of the trunnion. Loading and unloading operations can be automatic or manual.

The welding machine should be considered another member of the large machine tool family. With its acceptance as such, the corollary concepts of its inclusion into an automatic processing line become completely natural.

The proper application of weldamation, just as with automation, can achieve appreciable cost reductions. In many instances, it has been found more economical both in material and labor to produce a part in two or more pieces by automatically joining them by some form of automatic welding than to produce the part in one piece.

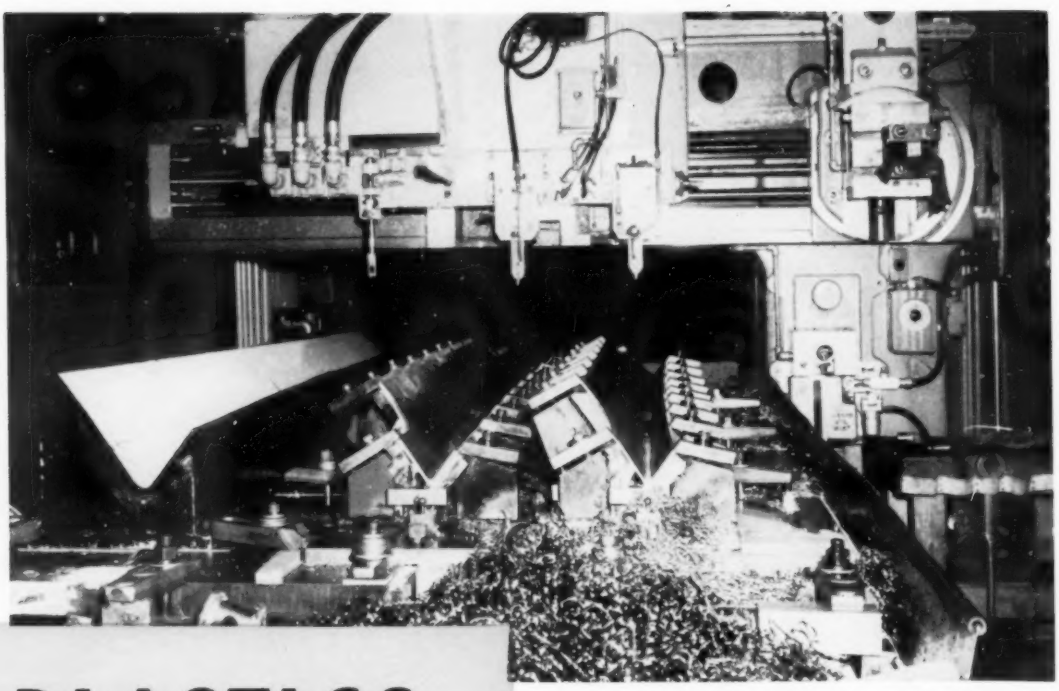


Fig. 1. Plastics tools for tracer planing aircraft parts. A plastics profile template is at left. Steel fixtures that have positioning surfaces of fiberglass-epoxy laminate hold the workpieces while machining.

PLASTICS TOOLING cuts lead time

By M. B. Newburger
Tool Engineer Sr.
and
H. B. Pawasarat*
Machine Tool Design Supervisor
Douglas Aircraft Co., Inc.
Long Beach, Calif.

IN THE AIRCRAFT INDUSTRY, producing large parts in minimum time is a constant problem. Often production volume is low and lead time for tooling is short. Plastics tools, because of their low cost, ease of construction and versatility, provide quick, economical tooling for such low-volume jobs. Tools of fiberglass reinforced epoxy resins—used extensively for dies, contour check tools and other fixtures—are now being applied to profile templates and milling fixtures, *Fig.* 1.

These tools are used for production of AISI 4340 stainless steel "attach tees" which tie the wings of a jet airliner to the fuselage. The attaching fittings are made in the form of a T-section. Each surface is a lofted contour and is contour planed to close tolerances. For holding the parts, a steel-box construction, *Fig.* 2, is used for the basic structure of the plastics-faced fixtures to withstand shocks. Where shock is not a problem, such as when using profile templates, or when excessive weight hampers handling, the basic tool structure is built of plastics and reinforced with phenolic honeycomb paper, *Fig.* 3.

Steel-Box Construction: A negative plaster cast is made for each fixture from a master mock-up. In order to accurately rig the steel box to the cast, tooling balls are placed in the cast at known points. After a fiberglass laminate is laid up to each cast, the steel box is rigged over the laminate and positioned with the aid of the balls. Cast, laminate and steel box are tied together to allow revolving the fixture into the best position for pouring a matrix. The matrix material is a casting resin compounded

*Senior member ASTE Long Beach chapter.

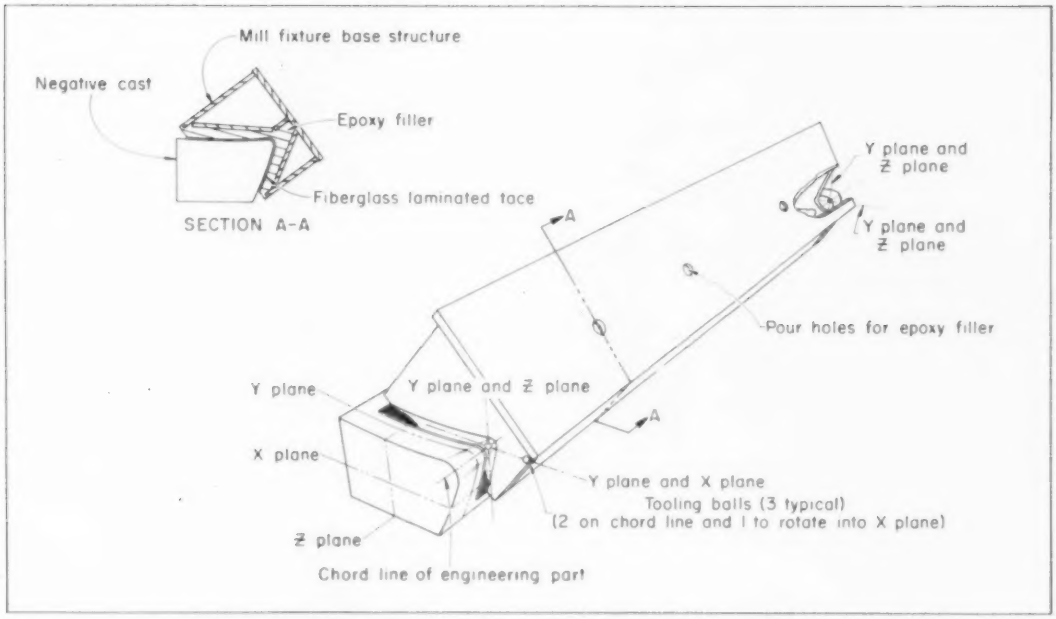


Fig. 2. Construction of holding fixtures for tracer planing. Steel framework provides necessary strength for heavy clamping.

to generate only a small amount of heat during curing. When the plastics material is fully cured, the plaster cast is removed.

All-Plastics Construction: The casts and the laminate faces for the lightweight tools are prepared in the same manner as those for a steel-box construction. When the laminate is laid up, plywood walls, or dams, are placed around the tool face. The edges of the dams establish roughly the plane of the base of the tool. Fiberglass and resin are then applied one-quarter inch thick to the inside of the plywood enclosure along with phenolic paper honeycomb cross member reinforcements.

After the plastics is cured, the dams are removed. Before separation of the cast from the tool, rigging lines are scribed on the tool from information on the plaster cast. After the tool is removed from the cast, it is positioned over a precision surface plate. Angle brackets are clamped to the surface plate and attached to the tool with resin and fiberglass. A honeycomb base is then fastened to the tool by bolting the brackets to aluminum blocks inserted in the base.

Vacuum fixtures of similar plastics structure have also been successfully adapted to machining operations on parts with thin sections and parts with compound surfaces.

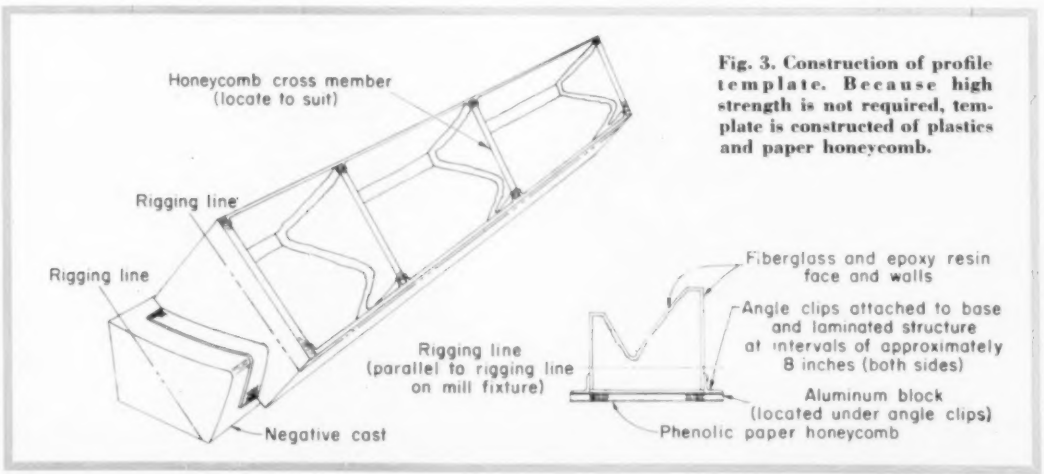
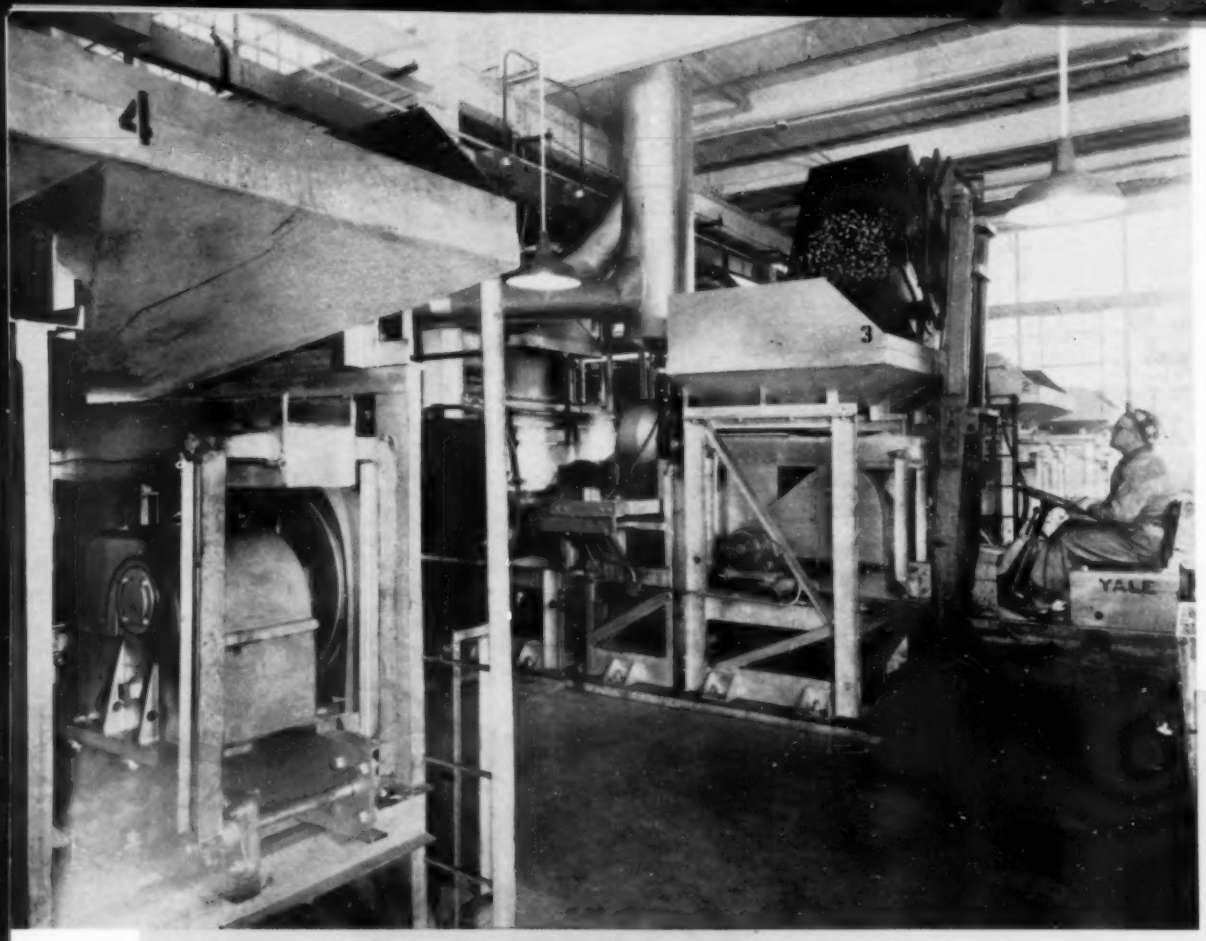


Fig. 3. Construction of profile template. Because high strength is not required, template is constructed of plastics and paper honeycomb.



LIFT TRUCK loads skid of cones into a twin hopper bin at a four-line battery of heat-treating furnaces. Vibrators fill drum metering devices that weigh parts for loading.

Heat Treat Automation

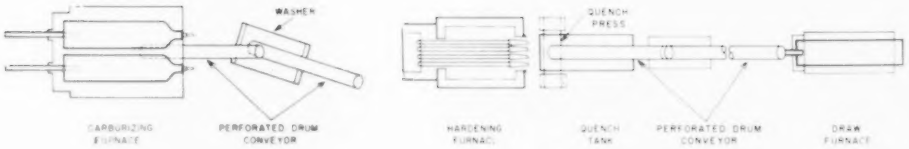
Utilization of full automation is practical when large quantities of identical parts are produced. Heat treating of roller bearings at Bower Roller Div. of Federal-Mogul Bower Bearing, Inc., is a classic example of automation carried to the fullest practical extent.

There are eight furnace lines, containing a total of 22 continuous furnaces, designed and built by Surface Combustion Corp. These furnaces are located in three different departments which manufacture the three major components of bearing assemblies: cups (outside races), cones (inside races) and rollers. Close coordination insures smooth flow of parts.

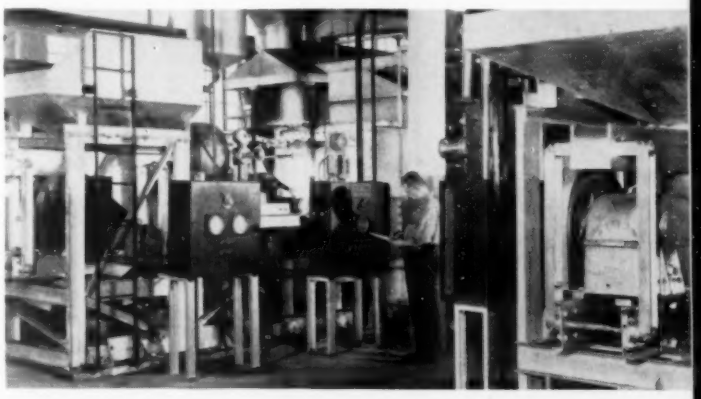
Four furnace technicians per shift see that all mechanical devices are functioning properly and that "bottlenecks" do not occur. Technicians do not load or unload furnaces or make repairs. Mechanical troubles are corrected by maintenance men; stock handlers load the furnace hoppers and remove the finished work by lift truck.

All temperature control instruments are located in a metallurgical laboratory. Samples from various points in the heat treating lines are periodically checked in the laboratory. The totally mechanized setup has cut rejects 50 percent, reduced over-all costs and improved quality.

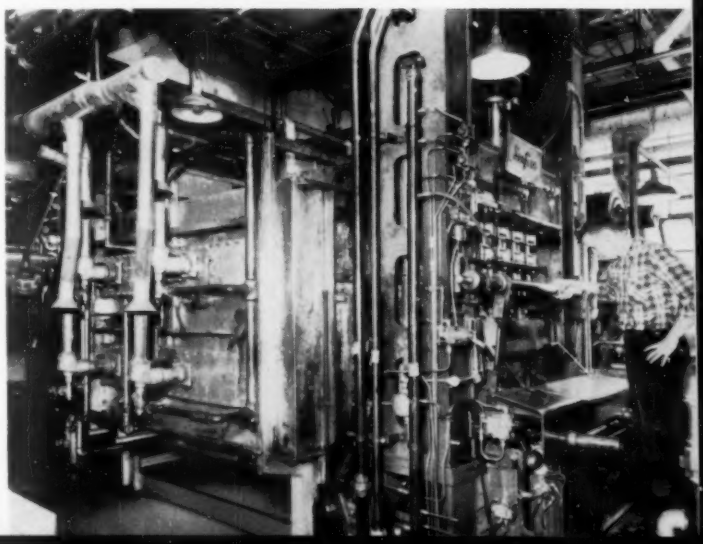
TOOLS at work



ONE OF TWO IDENTICAL LINES for heat treating of bearing cups at Bower Roller Bearing Div. Each line consists of a carburizing furnace, a pusher type reheat furnace, a press quenching machine and a recirculating air draw furnace of the revolving retort drum type. Two quench tanks and two industrial washers are included in each line. System of vibrating drum and belt conveyors keeps parts moving.

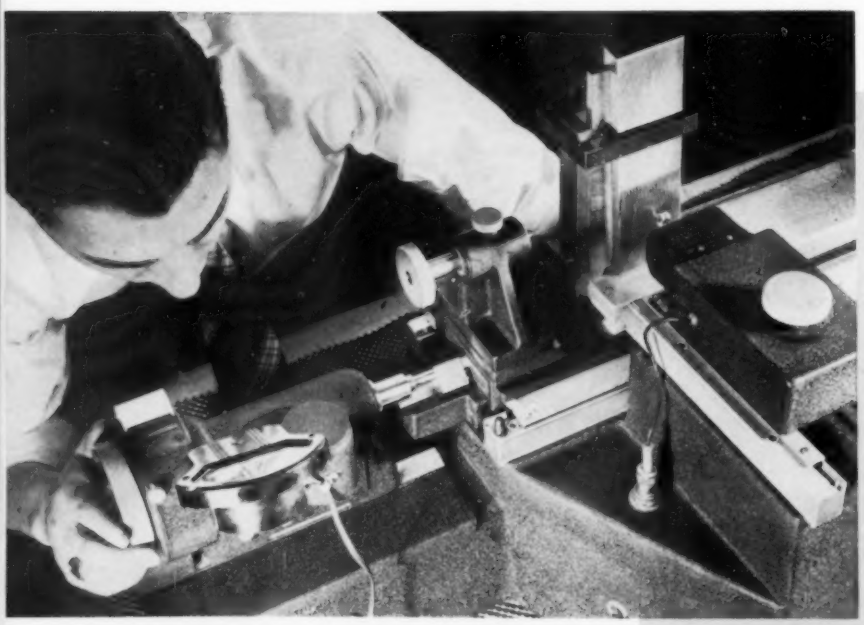


CUPS ARE LOADED into twin hopper bins to start the heat-treating cycle. Time clocks synchronize all phases of operation. Parts are spot-checked for hardness, case depth, size change and carbon content. Laboratory informs technician of any necessary adjustments to keep products uniform.

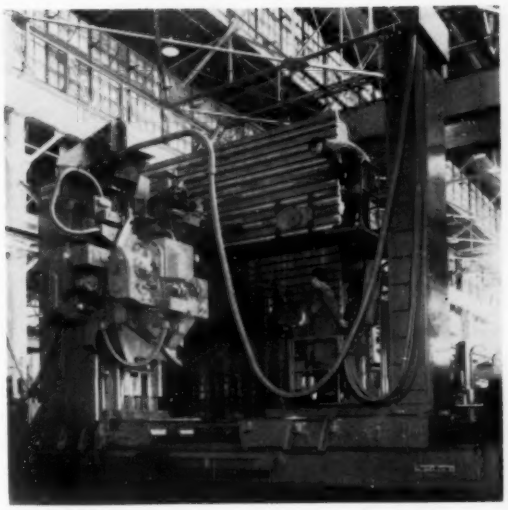


QUENCH PRESS is synchronized with the rest of the heat-treating operations in production lines at Bower plant. The steps before and after quenching illustrate the degree of automation that has been applied. Parts pass through the reheating furnace four at a time. As they drop out of the furnace they slide onto a chute that leads the parts to the quenching press platen and into the ring of the press. Quenched parts fall into a cooling oil tank, then travel up an inclined rotary drum conveyor to a rotary spray washer and dryer. A rotary recirculating air furnace completes the heat treatment and parts drop into pans.

EMPHASIS ON RELIABILITY has led to greater recognition of the importance of mechanical assembly problems. Standard Pressed Steel Co., manufacturer of threaded fasteners, has opened three new screw thread metrology laboratories to aid fastener users in solving fit problems. Technician shown here is checking the pitch diameter of internal screw threads on a universal measuring machine.

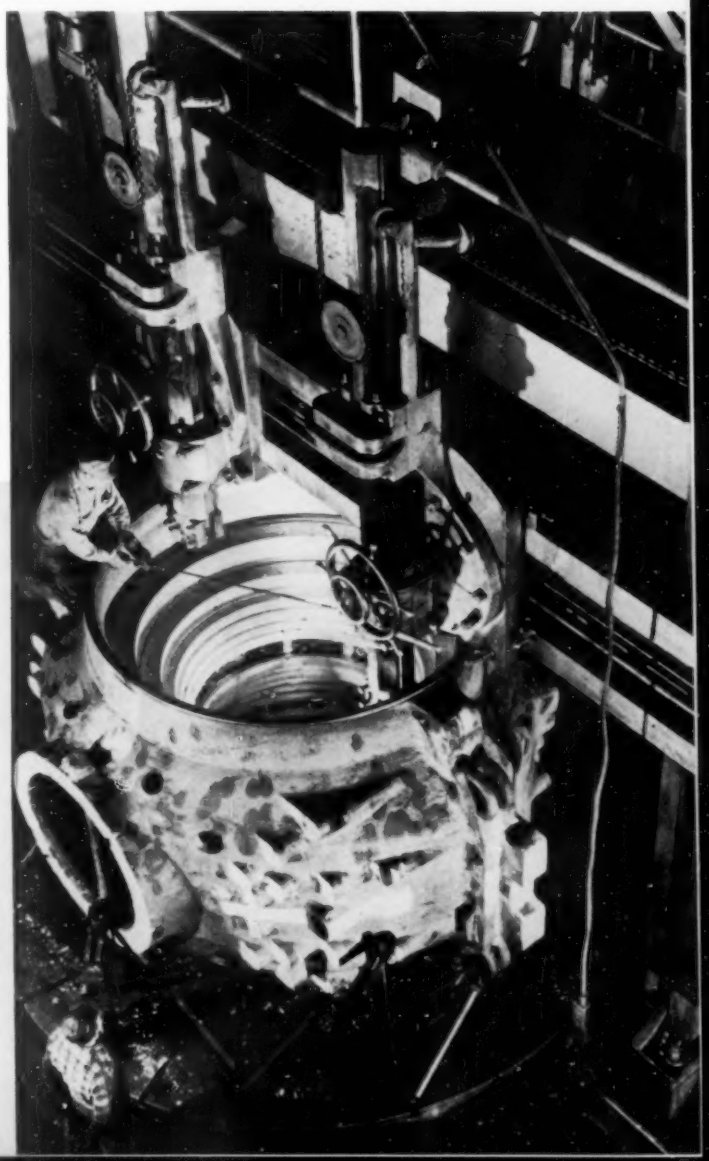


LEAD TRAVERSE of thread rolling die is determined on precision measuring machine at a Standard Pressed Steel laboratory. Lead is one of the most frequent causes of fastener misfits. The machine is capable of indicating deviation in thread-to-thread spacing to the nearest hundred-thousandth of an inch.



KELLER automatic tracer-controlled milling machine with a special milling head that can be tilted 20 degrees above or below the horizontal position is now in use at North American Aviation. The four-axis machine mills complex "warped" surfaces of aircraft components. Previously, three-dimensional tracer-controlled machines were utilized for such operations. This entailed the use of a three-dimensional model and a large number of milling passes. The new machine, built by Pratt & Whitney, provides a faster, more direct method.

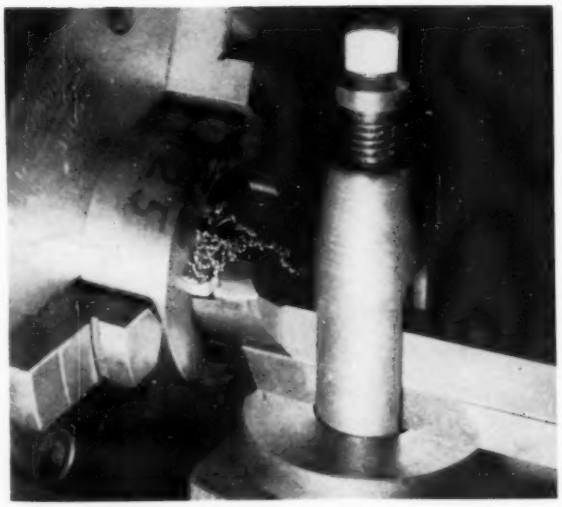
TOOLS at work



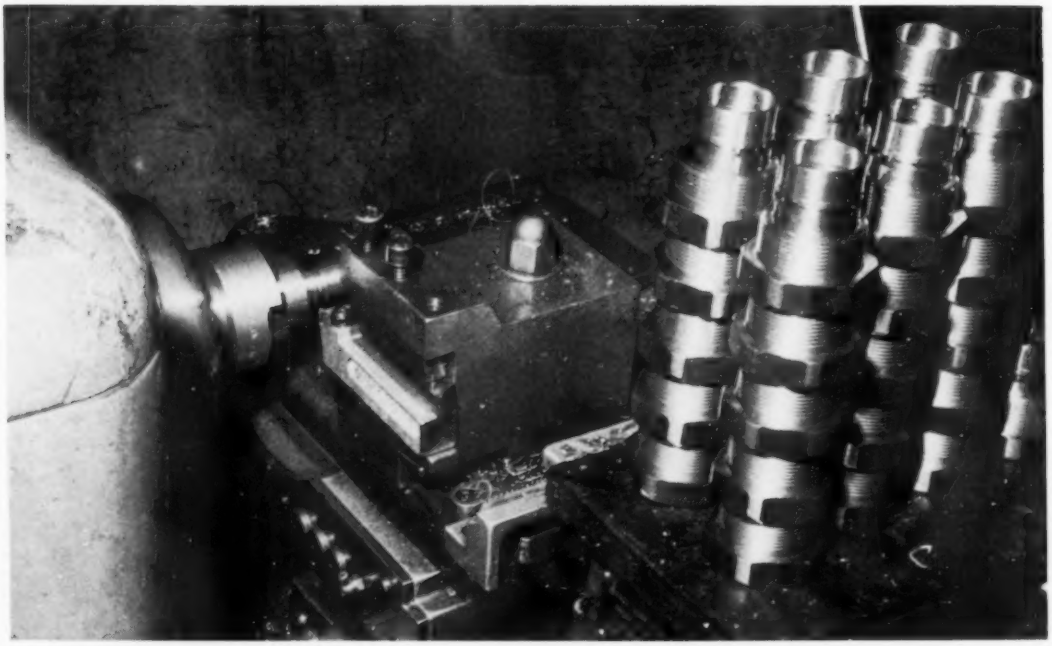
INTRICATE MACHINING JOB is performed by a 25-foot boring mill at the Union Steel Div. of Blaw-Knox Co. The workpiece is a cast steel cylinder blade ring for a steam turbine. Weighing over 100,000 pounds, the complex two-piece ring has walls of varying thicknesses and the interior is honeycombed with steam passages. The grooves being cut here are 5/8-inch wide, 4 to 5 inches deep. In use, the casting will be subjected to high operating pressures.

HARDENED PUNCHES AND RINGS (58-59 R_C) are machined with grade 0-30 cemented oxide tools at the Formax Mfg. Co., Detroit. The punches and rings previously were annealed, turned, rehardened and ground to alter the size and, in some cases, the parts had to be completely remade. The parts are machined on a South Bend 13-inch lathe at 250-375 rpm, 125-135 fpm. Feeds are 0.0035 inch, with a 0.010 depth of cut, and final finishes are 36-46 micro-inches, rms.

Part diameters range from 1 to 2½ inches. One-eighth inch of hardened stock is removed, with 0.003 inch left for grinding. The cemented oxide tools are made by the Metallurgical Products Dept. of General Electric Co.



TOOLS at work



THIRTEEN STEEL GUIDE BUSHINGS are now threaded for the former tool cost of threading one bushing in the Denver plant of Gardner-Denver Co. This saving resulted after changing from brazed carbide tools to "throwaway" insert tools. In addition, a 37 percent increase in threading speed resulted. The bushings have 2.122-16 NS threads. Material is SAE 8720 steel.

Cutting speed was increased from 290 to 442 fpm, which reduced threading cycle time from 0.646 minute to 0.404 minute. On a test run the speed was increased to 800 sfm, thereby reducing the cycle time to 0.227 minute per piece. However, 442 fpm allowed the operator more time to move pieces to and from his machine and gave better insert life. The feed is automatic—14 passes with equal amount of infeed per pass. The insert type tools are made by Kennametal, Inc.

COLD TREATMENT of stainless steel improves properties

By J. F. Baiseh and C. E. Hover, Jr.
Boeing Airplane Co.
Seattle, Wash.

STRINGENT mechanical property requirements are commonplace for materials used in aircraft construction. An example is 17-7PH stainless steel used for pressure vessels. Requirements for this steel are 165,000 psi ultimate strength minimum, 135,000 psi yield strength minimum, 10 percent elongation minimum and 39 R_C hardness maximum. At Boeing an extensive test program is being carried out to reduce the notch sensitivity of this steel. Two heat treatments are receiving critical comparative evaluation. The most promising of the two includes a subzero cycle for martensite transformation.

The alloy is normally received and fabricated in an austenitic condition. Heat treatment consists of two steps: transformation of the austenite to martensite and aging. Full transformation from nonmagnetic austenite to magnetic martensite is accompanied by a growth of approximately 0.6 percent. Aging reduces the net growth to about 0.4 percent.

In one treatment, known as the *TH* type, transformation is accomplished by heating to 1400 F, holding for approximately 90 minutes, and cooling to below 60 F. Normally, 50 to 60 F is the temperature used for this cooling treatment; however, additional strength may be obtained in some heats of material by cooling to zero or lower.

The second method of treatment is designated as *RH*. In this cycle the material is conditioned for transformtion at 1750 F. Transformation is brought about by a subzero treatment at —100 F. In either treatment welded assemblies are annealed at 1850 F for 20 minutes preceding the transformation cycle, and are aged at approximately 1100 F following transformation.

A cold cycle (0 to 32 F) has been used in conjunction with the *TH* transformation treatment on production size and small scale test pressure vessels. The small tanks were cooled in iced brine and the large pressure vessels in a controlled temperature chamber used for jet engine testing. No appreciable improvement in performance was noted in vessels treated in this manner.

Large and small pressure vessels and various test specimens have also been given the *RH* treatment.

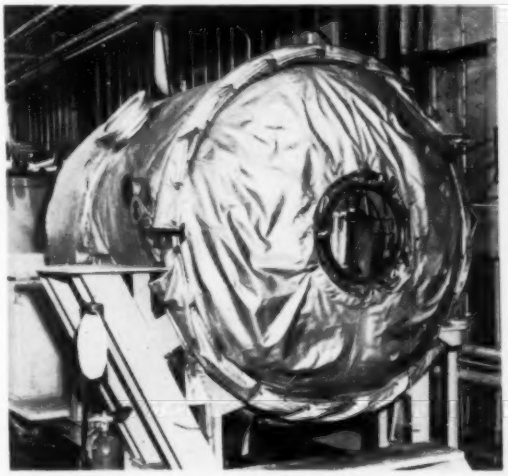


Fig. 1. Controlled temperature chamber used for subzero processing.

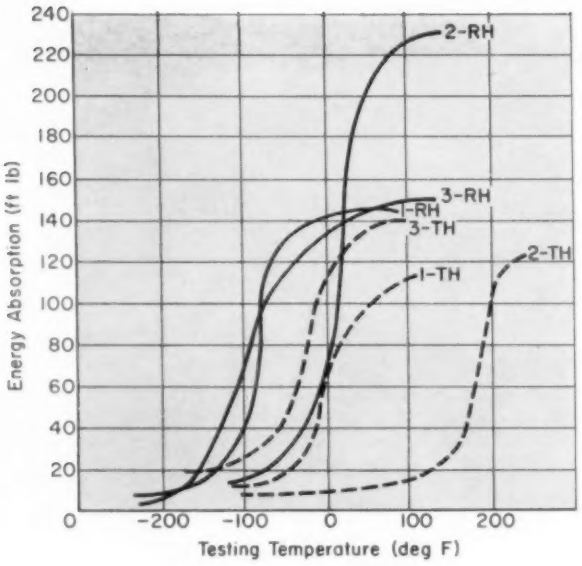


Fig. 2. Transition temperature of notch testing specimens is lowered by heat treatment with subzero transformation.

Subzero cooling (—100 F) of the small tanks and specimens was accomplished by immersion in a solution of methyl alcohol containing dry ice. The large vessels were cooled in a controlled temperature chamber shown in *Fig.* 1.

The most significant effect of the *RH* method is the lowered transition temperature for *RH* treated Charpy notch specimens. At the transition temperature the character of the specimen failure changes. The fracture changes from brittle to ductile in nature. Three pairs of curves are shown in *Fig.* 2. Each pair represents a set of *RH* and a set of *TH* specimens with nearly equal tensile and yield strengths.

Data collected from testing some 2000 specimens show that for a given tensile strength the *RH* treatment lowers the transition temperature about 150 F. At a given yield strength the transition temperature is lowered approximately 50 F. Also of significance is improved ratio of ultimate strength to yield strength found in 96 percent of specimens tested.

Recently an unusual application was found for cold treatment when a number of detail components of a large high-pressure vessel were inadvertently subjected to a cold treatment during transportation. Parts that had been fully annealed after forging and then machined to +0.01 percent dimensional tolerances in Cleveland, Ohio, were found to be +0.2 percent out of tolerance when received in Seattle. A weather trace of the rail routing of these parts revealed that they had been subjected to subfreezing temperatures ranging to —25 F for approximately four days. A superficial magnetic check indicated partial transformation, and the out-of-tolerance condition was attributed to growth occurring as a result of this "cold treatment" transformation.

Mating parts for inert-gas metal-arc fusion weldings were individually cold treated to obtain the same dimensional change. The parts were subjected to —65 F for an initial period of 90 minutes. This produced a growth of approximately 0.07 percent. A second cycle of 150 minutes at —65 F produced an additional change of 0.12 percent, minimizing the mismatch. In this instance the cold treatment was used to obtain dimensional refinement on close-tolerance parts that could not tolerate heat treat scale formation.

New uses of subzero processing are continually being uncovered. Several applications were discussed in "Subzero Temperatures Facilitate Production Processes," THE TOOL ENGINEER, Feb. 1958. The potential of this new area of manufacturing techniques has only just begun to be realized.

Blade Making Process Promises Economy

SIGNIFICANT technical advance in manufacture of aircraft and gas turbine compressor blades and vanes is in pilot production stage at General Electric's Ludlow, Vt. plant. The technique, called the roll and coin process, seems to solve the problem of producing blades having high ratio of air foil thickness compared with platform width at an economical cost while maintaining blade quality.

Smallest of the blades in one of the small aircraft engines, the T58 turboshaft engine, is little more than a half-inch wide while its thickness is 0.006 inch on the trailing edge. Design engineers insist on blade tolerances as low as 0.0015 inch for efficient performance of the T58's compressor.

Conventional methods for producing the blades, have proved to be either impractical or expensive. With the new technique engineers forecast a 50-percent cost reduction on each blade compared to those produced by other methods.

The new process includes a number of steps which may consist of extrusion, rolling, coining and trimming. However, there may be as many as 40 individual operations in manufacture of each blade. Although metal usually is preheated before extrusion, subsequent operations normally are performed cold.

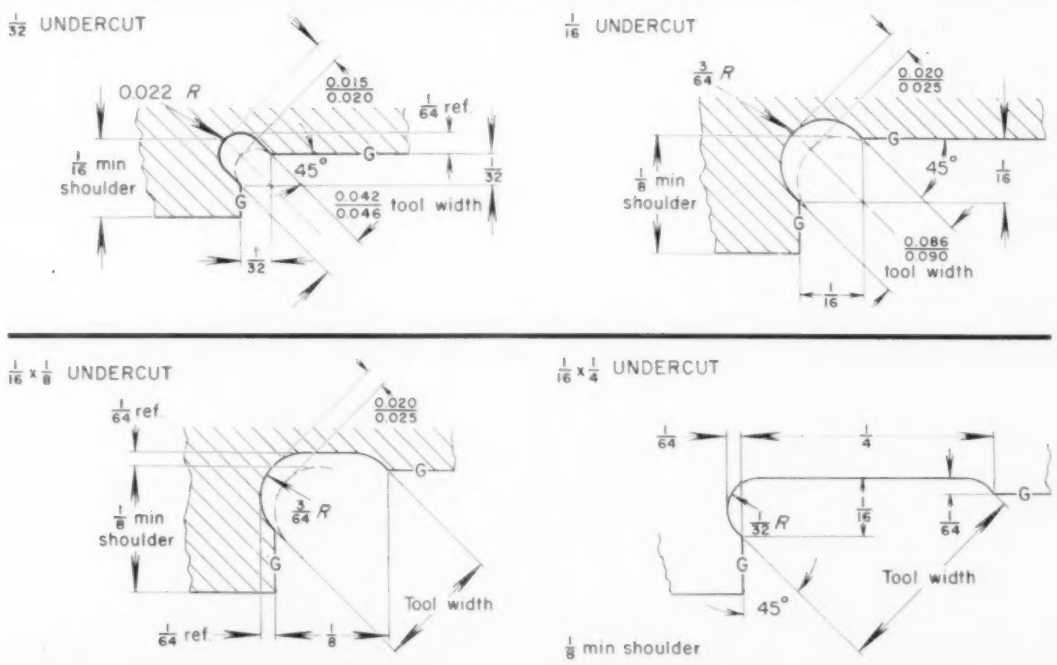
Specifying Undercuts and Reliefs

By Frank Zagar*
President
Zagar, Inc.
Cleveland, Ohio

WHEN UNDERCUTTING and relief grinding procedures are left to the discretion of machine operators, the results obtained are not uniform and the undercuts and reliefs may be inadequate. Best results are obtained when standard procedures are followed. The standards adopted by the Zagar company are illustrated in this Reference Sheet. Specifications are posted in the shop and referred to on part drawings by number. Different specifications may be applicable in other plants, but the basic principle of using standard specifications results in more satisfactory work.

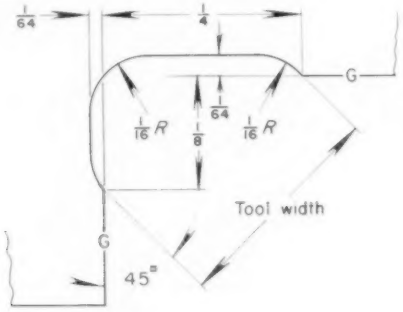
*Senior member ASTE Cleveland chapter.

Undercuts and Grind Reliefs



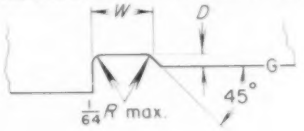
REFERENCE SHEET

$\frac{1}{8} \times \frac{1}{4}$ UNDERCUT



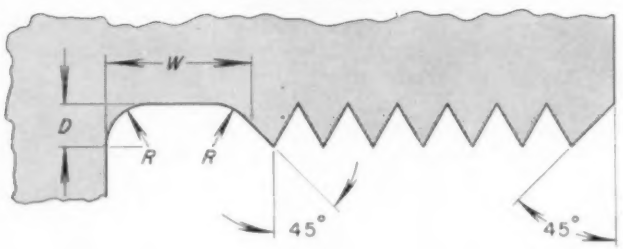
$\frac{1}{4}$ min shoulder

Grind Relief for "No Shoulder" Grind



W	Shaft Size Inch	D
$\frac{1}{32}$	$\frac{3}{32}$ to $\frac{1}{8}$	0.002
$\frac{1}{16}$	$\frac{1}{8}$ to $\frac{1}{4}$	0.005
$\frac{1}{8}$	$\frac{1}{4}$ to 1	0.010
$\frac{1}{4}$	1 and over	0.015

Thread Reliefs



Thread Relief (internal and external)			
Pitch	D (thousandths)	W	R
32 and finer	24–34	$\frac{3}{32}$	$\frac{1}{16}$
28	26–36	$\frac{7}{64}$	$\frac{1}{16}$
24	30–40	$\frac{1}{8}$	$\frac{1}{16}$
20	35–45	$\frac{5}{32}$	$\frac{1}{16}$
18	39–49	$\frac{11}{64}$	$\frac{1}{16}$
16	43–53	$\frac{3}{16}$	$\frac{1}{16}$
14	48–58	$\frac{7}{32}$	$\frac{1}{16}$
13	52–62	$\frac{15}{64}$	$\frac{1}{16}$
12	56–66	$\frac{1}{4}$	$\frac{1}{16}$
11	60–70	$\frac{17}{64}$	$\frac{1}{16}$
10	66–76	$\frac{19}{64}$	$\frac{1}{16}$
9	73–83	$\frac{21}{64}$	$\frac{1}{16}$
8	81–91	$\frac{3}{8}$	$\frac{3}{32}$

Small Plant Beats Recession 92

Lure of Los Angeles 96

Meet 'His Honor' 98

In the National Spotlight 102

Chapter News and Views 103

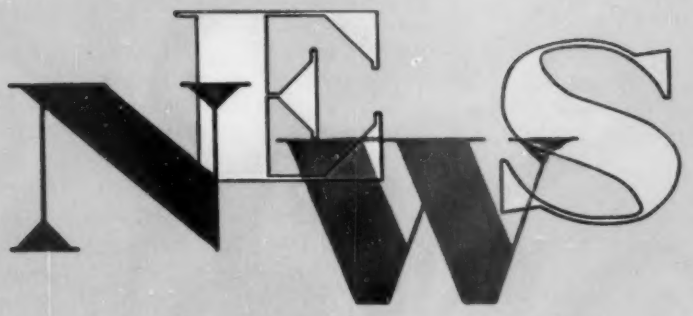
Tomorrow's Tool Engineers 104

Chips and Chatter 108

Coming Meetings 110

Members in the News 111

aste



Small Plant Beats

MANY small plants are being forced to operate on a shoestring these days. Some, however, are striding roughshod over economic timidity, and have actually had to expand production schedules to keep up with orders.

To compound the metaphor even further, one small plant has booted the recession right out of its door by operating not on a shoestring, but on a shoehorn. It increased its 1956 production of shoehorns—and some 200 other precision metal parts—by 30 percent in 1957, and plans to raise its 1957 output by 50 percent this year.

To get to the bottom of this boot-strap performance, THE TOOL ENGINEER recently paid a visit to the little factory in Crawfordsville, Ind., a county seat town of 13,000 people situated 45 miles northwest of Indianapolis. There it found 75 employees of Steel Industries, Inc., at work on a two-shift, six-day basis, and it found an unbeatable personnel record of 12 years in business without a layoff.

"It's Nice to Be Tops"

One of the key personnel is ASTE member Harold M. Oshry, vice president of the firm. Like many executives in small companies, Oshry wears several hats—or fills several pair of shoes! He is in charge of sales; he is part owner of the business; he is in general charge of manufacturing and research. And he's proud of it all.

"It's nice to be tops in something," Oshry said with a smile. "Well, we're the biggest thing in shoehorns."

Steel Industries makes 20 million of them a year, about 90 percent of the country's supply. But they have stepped out into other and nobler fields, and the shoehorn division now comprises only about 15 percent of their business. It's merely the bread-and-butter item, the staple product.

But the lackluster shoehorn, which kept the company on its feet in its early days, remains Oshry's first love. The firm went in the horn business in 1947, when it bought out the American Findings Manufacturing Co. (The "Findings" part of that name, by the way, has nothing to do with finding anything; it's a trade term for all products related to shoes.)

To Oshry, who is an MIT graduate and an experienced metallurgist, and to his seven college-educated and industry-wise fellow executives, the lowly shoehorn has been a real engineering challenge.

"We sell most of our horns for one or two cents apiece," Oshry said. "It's not easy to produce anything at that price. It took a lot of engineering. For instance, we decided a couple of years ago to put a little more bend in the finger grip. It cost us $10,000 to retool."

The horn is snipped from a roll of strip steel, stamped with the name of a shoe manufacturer or dealer, pressed to the desired shape, polished, and packed for shipment. A crew of five can process 30 tons of steel a month, produce 40,000 horns a shift.

Product Diversification

Most of the horns are standard, but there are some footloose and fancy-free models, too. There's an Ivy League type that's longer and has a gentle curve for the thumb instead of a hook grip. A special order species has a bottle opener on one end; a head-to-toe model has a comb attached; another comes with a stud for tightening golf spikes. And the company sells some 10,000 gold-plated horns a year—presumably for the man who has everything.

Oshry feels that no one factor can explain Steel Industries' success. Besides being the world's largest producer of shoehorns, the firm also manufactures components for metal brooms in large quantities. In addition to these prosaic mass production items, the company furnishes large quantities of cold-extruded transistor bases to the electronics industry and makes a variety of screw machine, stamped and extruded parts for the automotive and other industries.

Philosophies Are Basis of Success

This diversification has been important in keeping over-all production at high levels. The shoehorns are not subject to any wide seasonal or yearly fluctuations. Although the requirements for automotive parts have gone down during the past year, requirements for their electronic products are consistently going up.

Product diversification is not, in itself, always an infallible road to profits. The difference between success and failure is more often a matter of management philosophies, and how these philosophies are put into action.

The philosophy of Steel Industries is, like that of many other companies, the production of high-quality parts at the lowest possible costs. Oshry attributes

Recession

by T. W. Black, senior associate editor

Steel Industries' success to seven basic policies:

- Hiring the best personnel obtainable
- Continuous employee training
- Development of team spirit
- Making the most of available equipment
- Spending money where it counts
- Close quality control
- Continuous manufacturing research.

These policies are not unusual, but some definitely unusual methods are used to put them into effect. An engineering approach is followed throughout. Men—as well as machines—are tested before they are put to work in the plant.

Oshry says, with some pride, that it is easier to enroll in most universities than to get a job at Steel Industries. The "entrance requirements," which were designed by a consulting psychologist, are stiff. Each applicant is given a series of intelligence and aptitude tests before he is formally interviewed by management. Only those who are in the upper 20 percent in intelligence and have well-balanced personalities, as indicated by testing, are considered eligible for employment.

Machines Demand High IQ's

Oshry considers high intelligence as a basic requirement for employment because of the complexity of many modern industrial operations. On some screw machines, for instance, as many as 14 individual operations are performed. Each of these operations is a variable. Other variables are the machinability of the workpiece material, the effect of tool materials, cam design, tool design, cutting fluids and setup time. Where this many variables are involved, Oshry feels, a machine cannot be entrusted to someone with a fourth-grade education, particularly if he also shows up poorly in an intelligence test.

While press operations are not as complex as screw machine work, it has nevertheless been found that best results are obtained with high-caliber operators.

Most of the press operators at Steel Industries are women and all of them are high school graduates who have passed a series of tests, including one for dexterity.

Psychological testing has not only improved the personnel standards at Steel Industries, it has also enabled the company to make the best use of the employees it has. Any group of people is a reservoir of many talents and abilities and, as Oshry says, it is only enlightened self-interest on the part of management to find out what talents are available and utilize them to the fullest extent.

One toolroom employee had always been regarded as "clever." Psychological tests disclosed that he was indeed clever, and something of a mechanical genius. He was sent to college, where he is currently obtaining a degree in mechanical engineering in night school. During the day, he has filled a number of increasingly responsible positions at Steel Industries and has become a key executive.

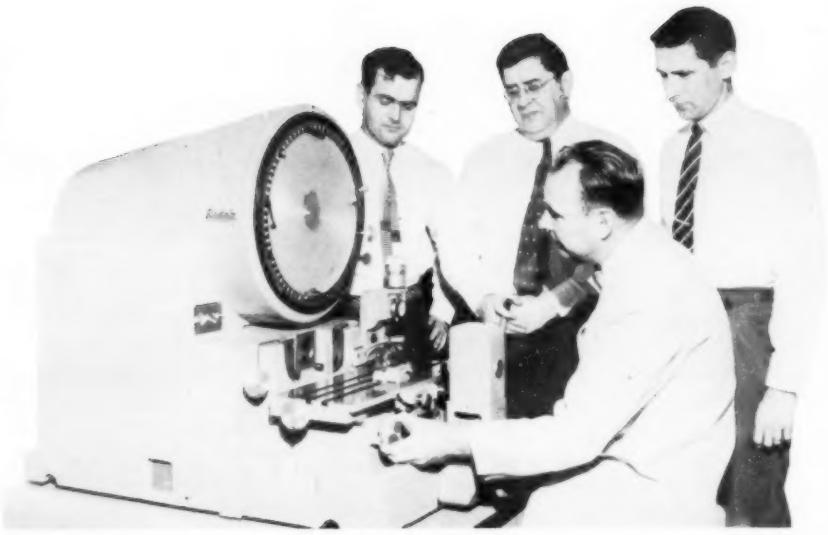
This points up the advantages of another Steel Industries policy—continuous education of employees. Much of this training is in engineering, going far beyond the job training found in many plants. Purdue University has figured in the educational programs to a large extent and 14 employees—mostly machine operators—are enrolled in a course in metallurgy at that institution. Their tuition is paid by Steel Industries.

Some production executives deplore the gradual disappearance of the old-time toolmaker and machine operator. He had the reputation of possessing loads of practical know-how despite his lack of technical education, and he substituted an intuitive knowledge of machines and metals for formal training.

In Oshry's experience, many of these old-timers were not exceptionally productive, and he feels that the best way to lick the shortage of good operators is to train them. The results bear out the wisdom of his contention. There are five screw machine operators at Steel Industries. Despite the fact that four of these operators had never seen a screw machine until three years ago, the operations are probably as efficient as any in industry. The reason—these operators were selected on the basis of intelligence and aptitude tests and then given exhaustive training at the plant of a screw machine manufacturer, plus on-the-job training at Steel Industries.

Members of a Team

Plant operations are team operations, and the company does everything it can to make all the workers feel that they are important members of an important team. Products made by the plant are prominently displayed, as are copies of magazine articles indicating progress in the industries served by Steel Industries. Other displays show how component parts produced by the company fit into washing



Looking over their firm's latest acquisition—a contour projector—are (standing) Basil Dulin, production supervisor; Harold M. Oshry, vice president; and Dale Feldman, engineering supervisor. At the controls is Nathan A. Phelps, quality control supervisor.

machines, electronic equipment, aircraft, automobiles and similar end products. All of this helps to engender a "we" rather than a "me versus the company" attitude.

While communications between management and workers would seem to be easy in a small company, Steel Industries has found that many gripes simply do not come out in day-to-day contact. Accordingly, to determine how the workers feel about the company, a questionnaire is sent to every employee each year. A typical questionnaire has over 70 questions and asks the employee how he feels about his job, working conditions, benefits, supervision, pay and other factors.

When the first questionnaire was distributed several years ago, Steel Industries management was surprised to learn that most employees thought that their pay and fringe benefits were low by industry standards. A survey of other industries in the area showed that this belief was unfounded—actually the pay and benefits compared favorably with any.

Poor communications were blamed for the misunderstanding. When management released the results of the survey of other industries, there was a change of opinion by the majority of the workers. The next questionnaire reflected a general satisfaction with pay and benefits at Steel Industries.

Complaints and suggestions are given careful attention. A "gripe committee" attempts to resolve the complaints. Oshry feels that a few dollars spent in altering the height of a worktable or making some other small change on the basis of a worker complaint will pay off many times in improved relations and morale. This in turn will boost productivity.

Oshry defines engineering as "getting the most out of the least." In practice, this means obtaining maximum productivity with the minimum possible investment in machines, time and materials. To achieve this objective, Steel Industries follows the practice of thoroughly preplanning each job, regardless of production volumes. Process sheets for screw machine parts, for instance, contain a drawing of the part for each operation, showing the critical dimensions and a verbal description of the operation ("Finish form thread blank to 0.4743"). Feeds, speeds, cams, toolholders and tools are also specified.

Because the job is fully preplanned, it can be set up quickly—an important consideration in a shop where a wide variety of low-volume parts is run. Also, maximum productivity is obtained during machining since the progress has been planned on the basis of scientific study.

Maximum flexibility is emphasized in all planning. Standard machines and equipment are used wherever possible. Experience at Steel Industries has demonstrated that it is often feasible to design a simple attachment for standard equipment to convert it for mechanized or special operations. Flexibility in plant layout is also considered essential. Presses and machine tools are mounted on pads, eliminating the need for costly foundations and simplifying layout changes.

A basic dictum of Steel Industries' management is to spend money where it counts. An example is the indoor loading dock. Few plants of this size have such facilities, yet they are important assets in inclement weather.

Another unusual feature of the plant is the provision of an overhead craneway leading from the unloading area to machining and stamping areas. At first glance, such an elaborate materials handling system might seem to be a luxury for a small plant. When the volume of material that must be moved is considered, however, spending the money for an adequate craneway is seen to be a wise investment. At Steel Industries, some 250 tons of metal per month is processed into some two million small parts. Much of this material is handled many times as it is moved through the various processing operations. The crane saves time and eliminates congestion in the aisles.

One part of manufacturing preplanning is keeping abreast of new developments in tooling. Oshry and his staff constantly review technical magazines, and they recently spent nine man days at the ASTE Tool Show, where they planned their purchases for the year.

As a growing company, Steel Industries has concentrated on buying used, rather than new, presses and other major equipment. Oshry feels that it is wiser to buy several pieces of good used equipment than one item of new equipment if only limited capital is available. A growing volume of orders has now created an interest in new equipment.

Plant Is Kept Functional

Another example of business acumen is furnished by what Oshry calls the "pipe rack" philosophy. Rather than investing in an impressive lobby, elaborate offices or extensive landscaping of the seven-acre plant site, Steel Industries management has kept the plant entirely functional.

Oshry himself, as vice president, shares an office with the company treasurer, a bookkeeper and several stenographers. A pot of coffee, always kept warm on a hot plate in the corner, is a reminder of the midnight hours that often must be kept by executives in a busy company that frequently has rush tooling programs.

Although the coffee pot is a 1946 model, the new toolmaker's microscope and other optical and mechanical gaging equipment in the quality control department are 1958 models. This emphasizes management's insistence on close control of quality. Certified inspection reports are furnished to customers with each shipment. Quality control inspection on screw machine parts is a combination of machine operator checks, random inspector checks and final inspection in accordance with MIL Standard 105A, modified to customer requirements.

Cold extrusion is only one of the phases of research and development work at the company. Research and experiments in other fields are carried on as needed. As Oshry says, "Once you know all the facts, the solution is obvious." Finding out the facts —before a part is tooled for high volumes—pays off in trouble-free production, Steel Industries believes.

As the reputation of Steel Industries has grown, it has been necessary for the company to consider the possibility of having to turn down orders due to lack of plant capacity. Oshry advises those who have similar problems: "Don't oversell your plant." As he sees it, it is virtually impossible for a company to conduct crash programs and squeeze extra production out of its machines without sacrificing sound engineering preplanning to some degree. Quality may suffer and production costs may get out of line. Accordingly, Oshry favors carefully planned long-range expansion programs, even at the expense of short-term profits.

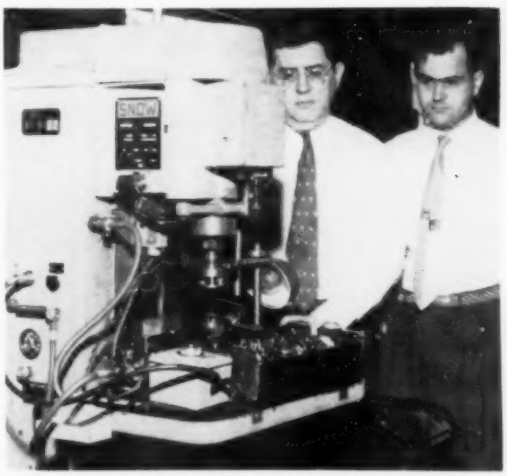
A 2000-Year-Old Formula

Leadership, Oshry says, has to come from the top. He expects employees to work hard, but he expects himself to work twice as hard. Further, as an engineer, he keeps on top of engineering developments in the company so that his technical know-how matches that of his engineers.

All of this takes hard work, but as Oshry puts it, the key to successful management is to find good people, pay them well, train them—and work hard. The managers of small companies must put in long hours. One form of payoff is business success. Another payoff, even more important so far as Oshry is concerned, is personal satisfaction in a job well done.

Oshry has one other basic formula for business and personal success. He feels that it should be applied in dealing with workers, customers and everybody else. This formula has been available to business executives for nearly two thousand years and it can be expressed in just four words:

Apply the Golden Rule.



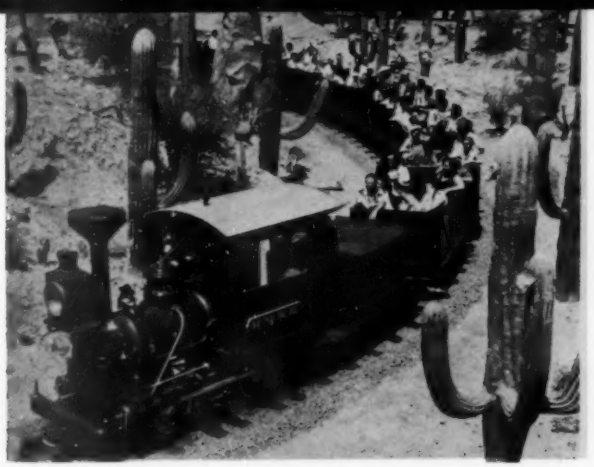
Harold Oshry and Basil Dulin study a drill press operation at their plant. The machine is thread-rolling transistor bases for the electronics industry.

The Lure of Los Angeles

Marineland . . . mealtime for the porpoises

LOS ANGELES, city of sun and smog, the DC-8 and Donald Duck, Marineland and the Farmers' Market . . . tourist mecca magnifique, and an industrial giant just beginning to come of age . . . this is the site of ASTE's Semiannual Convention and Western Tool Show, Sept. 29 through Oct. 3. While the Shrine Exposition Hall will house the Show and technical sessions, the Biltmore Hotel will be the Convention headquarters, with plant tours and sightseeing trips fanning out from there daily. A complete convention schedule will be published in THE TOOL ENGINEER in September. Shown here are some typical scenes that may add impetus to the age-old cry of "Go west, young man . . ." and, we might add, young woman, too. And in California, everyone—from nine to ninety-nine—is young.

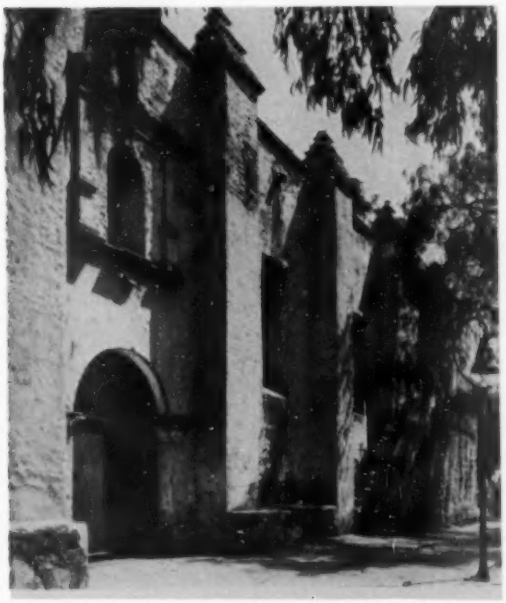
Petroleum industry . . . ranks sixth



The painted desert . . . Disneyland version

Area's specialty . . . electronics

Industrial giant . . . the aircraft factories



San Gabriel Mission . . . one of many in the area

Home of Capitol Records . . . Hollywood

The ASTE is getting big, so big that THE TOOL ENGINEER fears names will be buried by numbers. We don't want to lose sight of the fact that the Society, after all, is made up of some 39,000 individuals. To revive the intimate perspective—to look at the trees despite the forest—here's some news that's not national or regional, or even chapter level, but strictly personal. It's the second in a series of profiles of tool engineers.

Meet 'His Honor'

To John F. Kopczynski (pronounced just as it's spelled), simplicity is the father of invention.

John disciplines himself to see things simply. He has to work hard at it—for, besides being an inventor, John's a mayor, an industrialist, a factotum in his community, a champion of charitable causes, a member of this and that (including Buffalo-Niagara chapter of the ASTE), a father of two, and a taxpayer. In short, he's a busy citizen in a complex civilization, and life is anything but simple.

"If a man can look at a wheel, nothing but a wheel," John says, "and wonder how it would work if it were oval and not round—then he's on the right track toward thinking creatively."

The new mayor of North Tonawanda, N. Y., did just that back in 1939, when he was a student at Rochester Tech. He read of Admiral Byrd's difficulties designing a vehicle that could operate efficiently in snow, and he thought of the circus clowns he had seen on their egg-shaped wheels.

19 Years and $10,000 Spent on Wheel

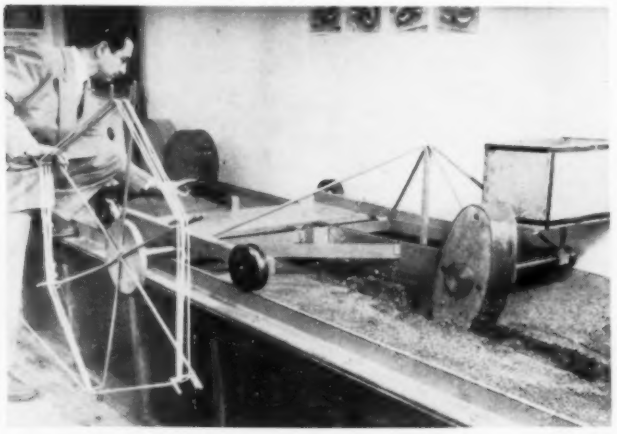
That thought started John Kopczynski on a project which he still clings to as tenaciously as his elliptical wheels grip the mud. In the 19 years since, he has spent many hours and more than $10,000 developing this one simple but revolutionary idea. He has taken out several patents on his Walk Wheel, as he calls it, and he has a good-sized file cabinet chock-full of correspondence about it from nearly every spoke in the Pentagon. He has demonstrated it in mud and sand and snow and on the open road to the armed forces and thinks that at last he's near to proving his point.

His wheels provide better traction because they're not round, he says; likewise they avoid the disadvantages of the caterpillar track.

What about the bouncing? Simple. John overcame this constitutional bent of his wheels by doubling it. He placed a pair of them on each side of his vehicle so that one wheel has its flat side on the ground while its running mate is standing on end. One wheel digs in to give a "toe hold" while the next one gives "flat-footed" support. He connected the hubs with a rocker arm, which reacts to the off-center motion of the wheels like a seesaw. The center point of the seesaw rides smoothly, and is attached to the axle. . . .

"If I find myself looking at something, thinking how to improve it, and find myself *adding* to it, I know I'm not solving the problem," John explains earnestly. "I try to look at it with a child's eyes, take away the trappings, strip it to the essentials, see it simply. Break it down to its simple elements, then work from there."

So at various times during his dissimilar days, between civic events and trouble shooting, between his mayor's desk and his desk at the Pivot Punch & Die Corp., of which he is founder and half-owner,



Inventor Kopczynski manipulates an oval wheel rig in his indoor experimental traction sand tank.

Tool engineer Kopczynski demonstrates his ultra-speed St. Mary's Spindle.

the Tool Engineer

by M. L. Stone
News Editor

J. Kopczynski

he speeds down the Tonawanda lanes to his home on Sweeney Street on the banks of the Erie Barge Canal, and goes up in his attic to think about ways to improve things.

His formula for a day's work is to lack a formula. "I don't plan for anything but a few routine matters. I try to pop up where the troubles are, keep myself flexible, and let the rest take care of itself."

Sometimes he works thirty-six hours at a stretch —sometimes only three.

John has over 40 patents covering a wide diversity of applications in a wide range of fields. His creative crusades have led him from tool engineering and mechanics into physics, medical research, and astronomy.

And most recently, he's facing perhaps his greatest challenge in "keeping it simple"—politics.

The chairman of the Democratic organization in North Tonawanda, city of 30,000 people, called him up last fall and said without preface, "We want you to run for mayor."

Winner in a Not-So-Simple Game

It was a surprise to John, but not to a lot of people. He was good, competent, innocent material. His backers could offer the voters a successful businessman who had parlayed an $1800 investment in 1945 into one of the largest corporations of its kind in the country; a gregarious and effectual community worker who had received the distinguished service awards of the Lions Club and the Junior Chamber of Commerce and the American Legion award for Americanism; a member of the board of regents of Canisius College, who had also served on the advisory board of the Kenmore Mercy Hospital and on the executive board of the Community Chest; the highly moral son of Polish emigrants who had proved himself, at 41, to be one of the nation's outstanding inventors.

John Kopczynski couldn't lose, even in the unsimple game of politics.

His defeat of the incumbent mayor, by 5198 votes to 4422, was called an upset in normally Republican Niagara County. John waged a "hard, clean" campaign, as the political vernacular puts it. He insists to friends that personalities were not at issue. But those who know John—his frequent smile, his low voice with a hint of a lisp, his calmness that just manages to conceal a capacity for excitement and enthusiasm, his hesitant but effectual gestures—think that personality must surely have been an issue.

The new mayor plans to bring the inventor's and businessman's approach to municipal problems. Whether such an approach will prove to be practical remains to be seen: he faces a 4-to-3 opposition majority on the city council.

He brings imagination to the job, too, and a flair for showmanship. Once he gave a free plane ride to 120 parochial teachers, so the sisters could tell their pupils how Buffalo looked from the air. To be fair, he then made the same gesture to public school teachers.

One of his first actions as mayor was to "roll up his sleeves"—just as all new office-holders do, he said—and help get a new $75 million power plant for North Tonawanda. He's now in the midst of putting through a $7 million arterial highway project for the Tonawandas, to relieve congestion in the cities' hearts and to open up land for industry.

One of his earliest and most revealing gestures as mayor was to give the local veterans' organizations the right to pick a civil defense director for him. His strategy was widely hailed by the Buffalo area press. But he confesses that the unique political move was dictated not so much by cleverness as by his inner feelings of chagrin because he was never in the service.

This sensitiveness to people and to others' viewpoints permeates his business and creative activities, too. For example, the Pivot Punch & Die Corp. was the first industrial plant in the country to employ a blind switchboard operator. John initiated the difficult project of having the board converted to Braille, but characteristically gives the credit to the phone company.

John feels that the idea might well be investigated

by other companies. The excellent influence on employee morale more than offsets the slight added expense, he says.

And it's his firm belief that his plant does not sell tools, dies, and special machinery so much as skilled manhours. He has always considered his workers the No. 1 asset of his company, and his personalized contacts with them, along with their liberal benefits, reflects this.

A few years ago the mother of one of John's friends fell down a flight of stairs and was critically injured. She was loaded into an ambulance and taken to a hospital, where she died soon after. From what doctors and friends told him, John became convinced that her death could have been averted if she hadn't been moved carelessly after the accident. So John took a look at modern stretchers, and found them antiquated.

Keen Interest in Medical Research

Working with medical men at a large Buffalo hospital, he designed and built a litter onto which a badly injured person could be loaded with a minimum of movement. Again, simplicity was the keynote. The stretcher was a thin but strong strip of canvas, big enough to hold a body but thin enough to be folded like a parachute into a small cannister, to be kept airtight and antiseptic and ready.

At the accident scene, the ambulance driver and his assistant remove the cloth from the tube, stretch it still folded under the back of the patient's neck or under the bend of his knees, and slip it almost effortlessly until it is underneath the body. Then the steel stretcher frame is lowered around the body, the cloth is hooked onto the frame at reinforced points, and the patient is hoisted gently into the ambulance. At the hospital, the ambulance attendants deposit the injured person on an operating table, unhook the cloth but leave it under the patient, lift away the stretcher frame, pick up a new cannister, and are ready for the next call.

It was this interest in medical research that caused John to invent one of his most marketable devices, the St. Mary spindle. The possibility of controlling cancer and other diseases through high-frequency sound waves led to the development of the new ultraspeed bearing device.

John is convinced that the bearings will significantly influence developments in the nuclear field, in radio broadcasting, telecasting, photography, and research into the effects of high speeds and heats on the molecular structure of metals and other materials. He has formed a new corporation, the St. Mary Mfg. Corp., to produce the bearings which can spin a shaft at speeds up to 500,000 rpm.

He believes his device makes it possible for metalworking shops to take fuller advantage of the cutting potential in carbides and ceramic tools without costly investment in new equipment. No special lubricants, gear trains or provision for extreme machine rigidity are required for the installation and operation of the spindle, he says. Even standard 3600-rpm electric motors coupled to the contact roll bearings can drive spindles at speeds beyond 70,000 rpm.

Basically the spindle consists of three intermeshing contact rolls. Two of them have a clearance groove, so that the third roll, which has a flange, is free to intermesh. The grooved rolls are mounted on motorized drive shafts which revolve the rolls clockwise, causing the workpiece to revolve counterclockwise. The third contact roll is an idler which serves as a rotary clamp. It is mounted on a pneumatically actuated dovetail slide, making it possible to clamp various diameters of workpieces and to permit rapid loading and unloading. The intermeshing principle permits varying speed ratios from 1:1 through 20:1, so that by driving the contact rolls with a commercially available 25,000-rpm motor, spindle speeds up to 500,000 rpm are readily attained.

Perhaps the invention that has contributed most toward the future education of his sons, John Jr. and Mike, 15 and 11, has been a new type of long-life, shock-absorbing punch which John perfected about 1948. Straight ground and with a soft metal

Mayor and family man Kopczynski poses in his living room with Alice, sons John Jr. and Mike.

sleeve to absorb vibration, the Pivot punch can produce holes with straight walls and no burr, to replace drilled and reamed holes, and it can perforate material thicker than the hole diameter. John claims this product can reduce die maintenance by 80 percent; can increase pieces per grind as much as 700 percent; and can up press capacity, because of less down time, by 20 percent.

The inventor analyzed the reasons for punch wear and breakage, and came up with a method of straight grinding round punches, or grinding them parallel to the punch axis. This boosts the life of the cutting edge and eliminates the circumferential fracture lines set up by cylindrical grinding. Since there's no standard punch for every job, John's firm provides more than 69 million combinations of point diameter, point length, over-all length, body diameter, and style.

He went to England to help set up production of his punches in a plant there, after Britons became interested in his exhibit at the 1947 ASTE Tool Show in Cleveland.

John admits that some of his ideas were perhaps better unborn. But he wouldn't hold them back even if he could: he sets his mind on what he thinks is the right road toward solution of a problem, and then he gives it free rein.

"Among the 'crackpots' are numbered the men with ideas who are responsible for our country's progress in the past . . . . and so dramatically demanded for the future," he says.

Some of his ideas, too, get nowhere even when they should, he believes.

World No Longer Beats a Path

"The old saying about build a better mousetrap and the world will beat a path to your door is obsolete. You have to bring the world to your door nowadays. You have to throw out an Oriental carpet and give them a piggyback ride inside."

John adds wryly, perhaps thinking of his Walk Wheel: "It's hard to sell something basically different."

One of his most controversial ideas has been his "Theory of Differentiation." It contends that celestial bodies revolve around the sun in an approximate elliptical orbit, subject to multiple forces and motions which give them this path. John thinks that the man-made satellites prove the truth of his theory, which he announced months before the first "moon" was launched.

He was excited as scattered information began coming in after Russia launched its first Sputnik, indicating that it was traveling an elliptical path around the earth. "This coincides with findings as they pertain to celestial bodies in the Theory of Differentiation," he told newspapers at the time.

"Sputnik actually has two orbits. It initially is revolving clockwise in an orbit of its own, with a diameter of approximately 300 miles, while traveling counterclockwise in a large orbit around the earth. Its path, because both orbits are circular and subject to outside forces and motions, is elliptical or eccentric."

Manufacturer Kopczynski chats with an employee alongside a large horizontal boring mill at the Tonawanda plant which he founded in 1945.

John demonstrates all this, too, with the aid of several balls suspended on strings from the rafters in his think attic.

He thinks all people have a certain amount of creativity, especially as children. But while the truly creative man retains and increases his God-given talent, the mass of people soon lose theirs.

"You can't develop creative minds on a production-line basis in our schools, no matter how good the schools are made to be," he warns. "Maybe the Russians got the first and biggest satellites in the air because of ignorance—maybe they succeeded because they are not hamstrung by literally too much knowledge."

He would urge the country to spend money and time, however, to seek out and cultivate the creative minds in its midst. "Useful ideas and useful men can be found in most unexpected places," he thinks. "The creative mind can solve problems by new approaches which many had deemed impossible.

"And remember, there's nothing that can't be improved. That's my philosophy," John declares. He adds, with a smile in his eyes and a slight twitch in the moustache which he grew to make himself look older, "And that's the philosophy of my wife Alice, too, about her husband."

In the National Spotlight

ASM Secretary Eisenman Dies

William Hunt Eisenman

NATIONALLY and internationally known figure . . . for forty years in the spotlight of the metalworking world . . . William Hunt Eisenman, secretary for the American Society for Metals, died May 30, at the age of 73, in a La Jolla, Calif., hospital.

In 1918 Mr. Eisenman, a native of Jamestown, Ohio, became general manager for a small metallurgical society, numbering 200 members and known then, in Chicago, as the American Steel Treaters Society. A group split from the Steel Treating Research Club of Detroit, it needed the help and direction of an experienced educator, such as Mr. Eisenman already was, to achieve its objective of exchanging and disseminating information about manufacture of high-grade metals.

Mr. Eisenman pumped his buoyant enthusiasm, and often his own capital, into the organization over the years. The splinter steel treating groups merged in 1920 and became the ASM, with headquarters in Cleveland. Today there are 102 ASM chapters in the United States and Canada, and 30,000 members—truly a living tribute to his efforts.

In the first year of his management, Mr. Eisenman conceived the National Metal Exposition as an aid to the financial stability of his society. Held every year since, the "Metal Show," as it is now known, is one of America's largest industrial expositions. In addition to the Metal Show, Mr. Eisenman directed the Western Metal Exposition biennially in Los Angeles for 20 years, and shortly before his death had launched the Southwestern Metal Exposition and Congress in Dallas.

He promoted the idea of a technical magazine to his board of directors and in September, 1930, the first issue of *Metal Progress* was published.

During the past year, Mr. Eisenman donated a 100-acre tract of his Geauga County farm east of Cleveland for the "ASM of Tomorrow," a $2,000,000 headquarters building for the society.

At the time of his death, Mr. Eisenman was scheduled to receive an honorary doctor of laws degree from Western Reserve University. He belonged to many American and foreign organizations. But more than anything else, he will be remembered for his close identification with ASM.

ASTE Research Fund releases latest report

RESEARCH Report No. 7, culminating a Columbia University study of temperature distribution in the workpiece, has been released by the ASTE Research Fund which sponsored the project.

Authored by M. B. Hollander and J. E. England of Columbia's mechanical engineering department, the 18-page treatise is titled "A Thermocouple-Technique Investigation of Temperature Distribution in the Workpiece During Metal-Cutting." It is adjudged of importance to industry since heat distribution governs the stresses set up in the workpiece and has great bearing on tool life.

The study provides an experimental check of the theoretical temperature predictions of Dr. Victor Paschkis' electrical-analog computer analysis, which appeared as Research Report No. 1 (1954).

The new booklet is available from Headquarters at $0.50 for members and $1.00 for nonmembers.

chapter news and views

Sacramento Chapter Is Host to Members Of AWS and ASM

Members of the Sacramento sections of the American Welding Society and the American Society for Metals were the guests of the Sacramento ASTE chapter at a meeting June 19.

Byron R. Russell, president of Airline Welding and Engineering Co., Los Angeles, spoke on a subject of special interest to technical society members in the Sacramento area—tooling and fusion of metals for the missile industry. His presentation included movies and samples of welds performed on difficult materials.

ASTE guests included Wayne Ewing, national vice president; Ben Berlien, national director; and Ralph Chrissie, vice chairman of the national membership committee. Other guests were F. Stevenson, director at large of AWS; Jack Porter, chairman of the Sacramento section, AWS; and Dr. E. R. Mertz, chairman pro tem of the Sacramento chapter of ASM. Each guest spoke briefly on the organization and goals of his respective society.

SACRAMENTO—Discussing "How to Organize for Success" are Jack Porter, chairman of the Sacramento section of the American Welding Society; Dr. E. R. Mertz, chairman pro tem of the American Society for Metals chapter in Sacramento; and Art Dzigorski, chairman of ASTE Chapter No. 145.

PEORIA—Deep in conversation during technical meeting are (left to right) Max Wessler, assistant professor of mechanical engineering at Bradley University; Bruce A. Rogers, metallurgist and research engineer, who spoke on "Atomic Energy and the Tool Engineer"; and "Bun" Funk, member of Chapter No. 31. —*J. R. Whitworth*

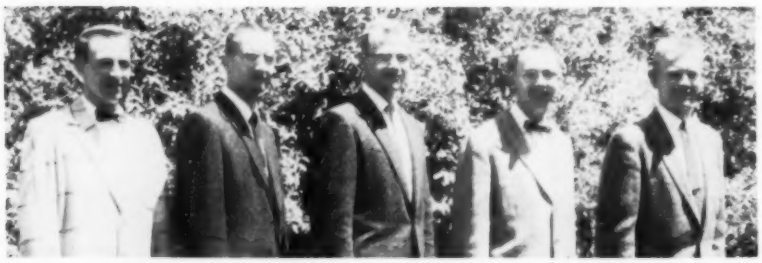
'Voice Under the Sea' Featured at Keystone

Extreme accuracy required in manufacturing amplifying sections of the transatlantic telephone cable was described at the June technical meeting of Keystone chapter, held in Scranton, Pa.

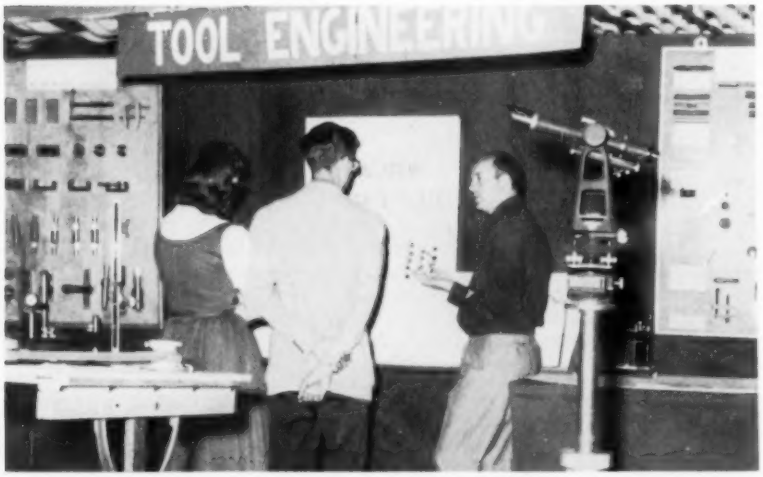
Roy Kaufman, engineering department head of the miniature electron tubes division, Western Electric Co., Allentown, was the speaker. He discussed the methods, materials, and inspection procedures employed in making the amplifiers, especially the use of pressure and isotopes in checking final assembly. His talk was augmented by a 30-minute film strip entitled "The Voice Under the Sea," which showed the laying and final splicing with some 40,000 welds. The transatlantic cable is owned jointly by Canada, the British postal service and American Telephone & Telegraph Co. —*Frank Forquer*

Tomorrow's

Utah State students, Salt Lake chapter hold joint meeting



Utah sun streams down on new officers of Utah State Chapter No. 2. From left are Treasurer Byron Low, Secretary Blair Muhlestein, Vice Chairmen Robert Wallentine and Dell Johnson, and Chairman William Eik.



Utah State student chapter set up a display on tool engineering for the edification of other students as a part of the campus exhibits program.

SALT LAKE CITY senior members joined the Utah State student chapter in the students' annual installation meeting on the campus May 16. Co-chairmen were S. H. Parsons, Chapter 85 vice chairman, and Carroll O. Hodges, outgoing student chairman.

Main speaker at the meeting which followed a smorgasbord was Col. Asa C. Black, military science and tactics professor, who talked on military missile developments. President Daryl Chase of USU spoke briefly on his recent trip to Iran, after which two students from Iran presented a musical program.

Prof. Frederick Preator of Utah State and the ASTE national education committee, recognized the following scholarship and awards recipients: Darrell D. Palmer, $700 national ASTE scholarship; Byron Low and Robert Everts, $100 scholarships from Salt Lake City chapter; Wayne Wright, $100 scholarship from the student chapter; and Robert Wallentine, Tool Engineer Award of engineer handbook and pin.

Les Seager, national ASTE director, installed the new student officers, shown in the accompanying photograph.

Professor Preator presented gifts to the outgoing student officers on behalf of the school's tool engineering department: Chairman Hodges; Jay Stewart, first vice chairman; Darrell Palmer, second vice chairman; William Eik, secretary; and Paul Siggard, treasurer.

Dinner climaxing Engineers Week was attendeed by (from left) Robert Wallentine, Vic Jorgenson, William Eik, Richard T. Smith, Dell Johnson, Carroll Hodges, Prof. R. Child, Engineering Dean D. F. Peterson, and Prof. Frederick Preator.

Cal Polytech hears atom scientist

National Director Ben Berlien presents gavel to California State Polytech Chapter Chairman Jesse Crews and his elected officers (reading right), Jim Ryan and John Carlton, vice chairmen; Chuck Pollard, secretary; and Ray Audo, treasurer.

PROF. RUSSELL B. LINDSKOG, atomic scientist, spoke on recent nuclear developments at the combined banquet, ladies' night and installation meeting of California State Polytechnic College chapter on May 24. One hundred five members and guests attended.

Outgoing Chairman Thayne Wilson presented a service pin for outstanding work to Bill Grubbs, outgoing membership chairman. Bill helped increase Student Chapter 12's membership from 39 to 124 members during the past year.

Jesse Crews received his $700 ASTE international scholarship from Ed Cutler of the national education committee. Recognition was given by George Adams of Los Angeles chapter to students Daniel Dickey and Fred Tarver for winning the Los Angeles unit's scholarships of $250 each.

The following committee chairmen were appointed: Gary Hughs, membership; Jim Barth, program; Buell Brown, editorial; Ralph Sealock, historian; and Marvin Tanner, Poly Royal. The last-named chairman directs chapter participation in Cal Poly's annual "Country Fair on a College Campus."

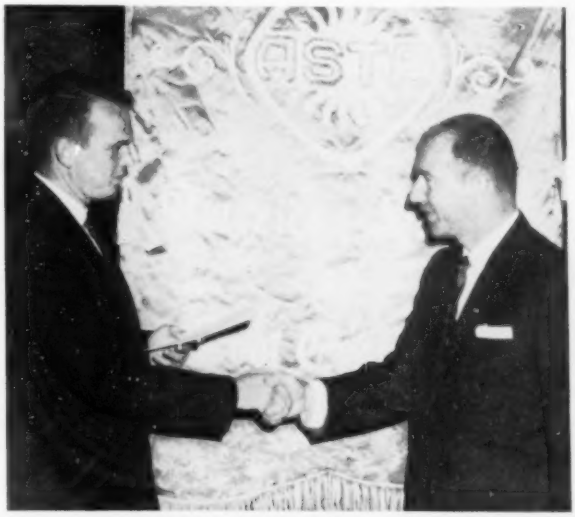
—Marvin E. Tanner

Indianapolis

Herman W. Stoelk, education chairman of Indianapolis chapter and professor at the Technical Institute extension of Purdue University, is shown with George B. Cowan, who received an ASTE international scholarship. The 20-year-old freshman, of Greenfield, Ind., is one of 80 student members in the Indianapolis chapter.

—C. J. Myers

Guests at Cal Poly installation were (left to right) Paul Lenk, Los Angeles past chairman and present editorial chairman; Ed Cutler, member of the national education committee; George Adams, Los Angeles treasurer; Faculty Adviser Francis Whiting; and (center front) Larry Pomerantz, Long Beach past chairman and national program committeeman.



Jesse Crews (left), member of Student Chapter 12, receives $700 ASTE international scholarship from Ed Cutler, member of the national education committee.

Detroiters enjoy "Roughing It" at the Falls

ALTHOUGH the destination was Niagara Falls when some 350 Detroit-area tool engineers boarded a special train one mid-May evening, they were not so much lured by the spectacular views to be seen at that honeymoon haven as by the prospect of inspecting Carborundum Co.'s 45-acres of plants, whence come the sandpaper and grinding wheels so familiarly known by the firm's name.

The all-night train ride stretched into a bus ride that took Detroit, Windsor and Macomb chapter members and guests, first to breakfast overlooking the Falls, and thence to the Wheatfield, N. Y., and Niagara Falls plants, homes of coated abrasive paper and abrasive wheels, respectively.

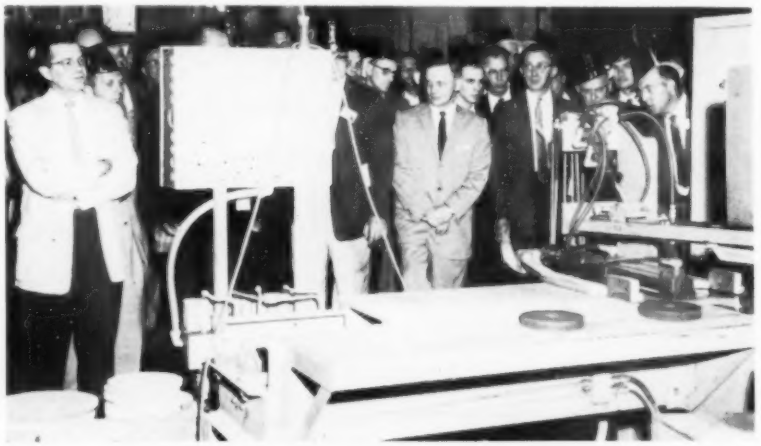
The company's beginnings in 1891 hinged on the invention by Dr. Edward Acheson of silicon carbide, the first man-made abrasive. From its birthplace in Monongahela City, Pa., Carborundum moved to its permanent home at the Falls in 1895, after signing a long-term contract for electric power from the Niagara Falls Power Co. Four years later a process for making crystalline alumina was developed, launching the company's production of fused Aloxite.

These two materials remain the principal manufactured abrasives used the world over, and Carborundum is the world's largest silicone carbide producer and the second largest fused alumina producer. Its plants now number 30, are located in 9 countries, and employ 10,000 people.

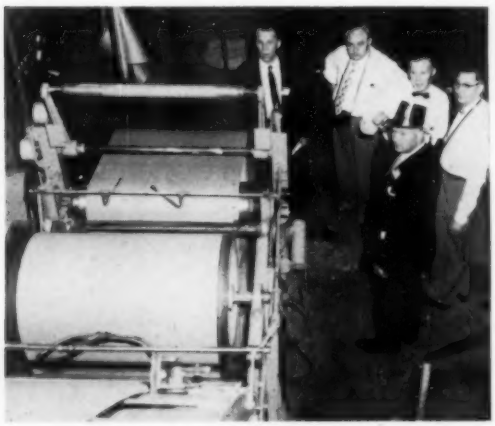
In Niagara Falls, the original Buffalo Avenue location has been enlarged again and again, and now accommodates the executive building and the research and development, electrominerals and bonded abrasives divisions, while the Wheatfield plant houses the coated abrasives division. At the executive building, visitors saw "Univac" processing customer orders from 12 sales offices.

Electrominerals division is equipped with electric arc furnaces for manufacturing the silicon carbide, aluminum oxide, and also boron carbide. It reduces these crude commodities to optical powders and abrasive grains for use in the many end products. At one point the tourists looked up at bins three stories high, each holding 40,000 pounds of abrasive grain, representing a large percentage of all that used in North America.

The management of the host plant made the trip more than a plant tour by creating a "party" mood with paper top hats, and providing breakfast and dinner at the Sheraton-Brock Hotel, lunch at the plant cafeteria, and of course, sightseeing tours of the nearby Falls. Thirteen hours after their 7 a.m. arrival, a weary crew boarded the return train for another all-night journey, taking with them a greatly enhanced knowledge of abrasives manufacture.



Visitors have a hard time keeping up with a new automatic abrasive wheel molding machine. A prototype of the ones for Carborundum's new wheel plant, the machine weighs and mixes abrasive grain and bond, pours it into a mold, molds the wheel, and kicks it out onto the conveyor.



Jumbo coils of sandpaper roll up at the end of this coated abrasive machine at the rate of four mph. Annual production would make a three-foot-wide sandpaper belt long enough to circle the globe.

The 9,000-lb. aluminum oxide pig undergoing inspection was produced by 16-hour exposure to temperatures of 3500 to 4000 deg. F. in an electric arc furnace. The pig will be reduced by crushers, graded, and fabricated into V40 tool room wheels.

Californians Plan Hawaiian *Luau* After Area Council Meeting

Representatives of the twelve California chapters, meeting August 16 to deliberate the problems of the editorial education, membership, public relations and technical publications committees, as well as those of chapter chairmen, will breeze through their "workshop" sessions, in anticipation of a Hawaiian-style *luau* to follow after adjournment.

Both the councilors and their wives, who did the *luau* planning, will participate in the revelry, consisting of native music, Hula dancers and Hawaiian food, catered by native Islanders, and lasting till dawn, in true native tradition. Proceeds of the festivities will be applied toward the scholarship funds of the participating California chapters.

Hosting the August Council Meeting will be the San Gabriel chapter, which has indicated La Hacienda Hotel as the meeting place. At the previous meeting of the council, which meets quarterly, San Fernando Valley acted as host, at the beach resort of Corona Del Mar. Seventy delegates, from San Francisco southward to San Diego, heard Vice President Wayne Ewing and Director Ben Berlien deliver incisive addresses before they adjourned to the individual workshop sessions. At these meetings, program, professional engineering, public relations and editorial questions were parried and resolved.

Relative roles of editorial, public relations, and "publications" chairmen were delineated, with the point being made that no national counterpart of the publications, or bulletin, committee, existed, and the suggestion given that the duties of such existing publications be defined at the national level.

Lansing Meeting Held At Computing Center

A high-speed, electronic, digital computer was demonstrated for 50 members of Lansing chapter at their monthly technical meeting. M. G. Keeney, instructor in the computer laboratory at Michigan State University's electrical engineering building, said the "medium-sized" machine provides a computing center for the use of staff and students in solving research problems that could not otherwise be attempted.

He ran through a sample problem to illustrate the computer's speed and methods of reaching a solution. The machine, he said, is valued as an aid to scientific research, rather than as a data computer. —*R. J. Krumrie*

DENVER—This panel discussed "What Industry Expects of Engineering Schools" at the seventh annual Rocky Mountain ASTE executive conference. Seated left to right are National Director Les Seager of Salt Lake City, moderator; Dave Proper of Sundstrand Denver; Ed Roos of the host C. A. Norgren Co.; Ted Wiberg of Gardner-Denver; Wayne Robb, Tooling Specialties Co.; standing, and representing education's point of view, Prof. Dick Crawford, University of Colorado; Prof. Wilbur Parks, University of Denver; and Joe Cook of Denver Opportunity School. Tucson, Albuquerque, Salt Lake City, Phoenix, and Omaha had conference representation. —*Dwight S. Taylor*

Little Rock Sponsors Course in Metallurgy

A course in basic metallurgy, consisting of five lessons and a final examination, will be offered by Little Rock chapter. The classes meet on consecutive Tuesday nights, starting Aug. 5.

Instructor will be Bob Rife, heat treat and plating technician. A certificate will be awarded upon satisfactory completion of the course. The fee is $5.

Lessons will be: history and characteristics of grain structure; heat treating furnaces; testing of heat treating; classification of steels; and analysis of heat treating baths. Copies of the lessons will be passed out at each meeting.

—*Bert Foster*

$750 in Scholarships Awarded by Hartford

Five scholarships totaling $750 have been given to Hartford area students by Chapter No. 7.

Ernest Osterling, chairman of the chapter education committee, presented the scholarships at the annual awards dinner held at the City Club in Hartford. Recipients were: Barry Lubin, $300, University of Connecticut; Edgar Brisson and Edwin Filip, $150 each, Hillyer College; and Lowell Yeager and Dominic Valuso, $75 each, State Tech. —*E. Russell Carter, Jr.*

San Fernando Valley Speaker Discusses Space

Contrary to general belief, Russian scientists have developed their rockets on their own, with little or no help from the Germans, members of San Fernando Valley chapter were told at their June meeting.

"Experiments in Space" was the subject of the talk given by Everett J. Urbach, head of reports and presentations of rocket projects, of the Aerojet Systems Div., Aerojet General Corp. Mr. Urbach discussed the background, planning, and current activities of the U. S. participation in the IGY, paying particular attention to this country's earth satellite program and the rocket vehicles that have established man-made moons in their orbits.

He sketched the nature of the geophysical information expected to be obtained from the satellites. The first satellite, he said, measured the ultraviolet light, the temperature in space and inside the sphere, erosion and meteor punctures; the second satellite measured cosmic rays and performed erosion experiments; and the third satellite measured the earth's magnetic field and air density.

Mr. Urbach contended that a manned satellite would be too vulnerable for use as a war machine, but could serve mankind best as a space laboratory for telescopic viewing of the universe, or as a base for exploring space. —*A. Hunter*

GOLDEN GATE—ASTE National Director Ben Berlien points to architect's drawing of the Friden Calculating Machine Co.'s new plant at San Leandro, Calif., during Chapter No. 28's tour. With Mr. Berlien are shown Charles Driesbock, chapter first vice chairman; and Roy J. Renholts, Friden factory manager. —*G. Kenneth Dunn*

Golden Gate Tours Office Machine Plant

Members of Golden Gate chapter toured the San Leandro, Calif., plant of the Friden Calculating Machine Co. The factory, largest of the company's six major facilities in this country and in the Netherlands, employs 3000 people and has 490,000 sq. ft. under roof.

Roy J. Renholts, factory manager, recounted the California corporation's growth from its founding in 1934 by Carl M. Friden, into its present position as one of the world's foremost producers of automatic calculating machines. He described new products which the company has contributed to the fast-growing complex of integrated data processing equipment.

Visiting tool engineers were divided into small groups, each conducted by a plant engineer. They saw the planning department's use of standard die design tracings, which cut die design time from 18 to 20 hours down to 2 or 3.

Members also watched Friden's two-color plastic injection molding press in operation, and witnessed electroplating of printed circuits and experimental part fabrication by a process of photography and electroplating.

Saginaw Valley

A panel discussed cold extrusion of steel at the May 15 meeting attended by 106 members. James F. Leland, sales manager for Parker Rustproof Co., Detroit, acted as moderator for the panel, which consisted of Al Braun and Braun Engineering Co.; Ronert Gardner, Verson Allsteel Press Co.; Howard Cousins, National Machinery Co.; and Ross Perry of Parker Rustproof.

Central Connecticut Takes First Tour

One hundred eighty members turned out for the first plant tour arranged by the recently formed Central Connecticut chapter. After their dinner meeting June 4, the group inspected the Torrington Mfg. Co. plant at Torrington, Conn.

The company manufactures a wide range of torsion, standard, extension, compression and special purpose springs. Visitors saw the company's high-speed tube and rod straightening machines and high-speed flat wire mills.

Chapter No. 148 now has well over 200 members from Waterbury, Torrington, Bristol, Southington, and surrounding areas. —*Henry J. Somma*

Monmouth Chapter Hits Education Program

Under the direction of Chairman William W. Halbrook, Monmouth chapter has engaged in an accelerated educational program to give local students a preview of tool engineering careers.

The chapter sponsored a broadcast over Station WJLK, Asbury Park, N. J. On the program, Chairman Halbrook and an official of the PTA discussed the aims of the ASTE and offered information on career opportunities for students interested in metal working.

The chapter also sent three busloads of students and their counselors from Monmouth County high schools to the ASTE Tool Show in Philadelphia. The trip was arranged by Emil J. Petach, chairman of the education committee.

The first education course sponsored by the chapter has been inaugurated, with Senior Member Eugene Norris of Bendix Aviation Corp. presenting a program on cost estimating. Dave Geschwatner, membership chairman, coordinated the program. —*J. J. Schubel*

Lehigh Valley

George Kane, first vice chairman of the chapter and assistant professor of industrial engineering, Lehigh University, spoke to 60 members at the May 16 "do-it-yourself" meeting. His topic was "Economics of Tooling," which evoked many questions from his audience. Mr. Kane wrote Section 21, entitled "Tools, Jigs and Fixtures," for the 1958 second edition of *Production Handbook*. Coffee speaker was Robert Hudson, who spoke on "The European Apprentice Program."

chapter activities

Binghamton 109
California Polytech 105
Central Connecticut 108
Chautauqua-Warren 109
Cincinnati 110
Denver 107
Elmira 110
Erie 110
Golden Gate 108
Greater New York 110
Hamilton District 109
Hartford 107
Indianapolis 105
Kalamazoo 109
Keystone 103
Lansing 107
Lehigh Valley 108
Lima 109
Little Rhody 109
Little Rock 107
Los Angeles 109
Mansfield 110
Milwaukee 109
Mississippi 109
Monmouth 108
Oakland County 109
Peoria 103
Rochester 109
Sacramento 103
Saginaw Valley 108
San Fernando Valley 107
San Francisco 110
Santa Ana Valley 109
Tucson 106
Utah State University 104
Western Reserve 109

chips and chatter

Mississippi

"Heat Treating under Controlled Atmospheres" was the subject of a talk given by Russell F. Novy of the research laboratory at Lindberg Engineering Co. Slides accompanied his talk, showing curves of controlled temperatures relative to gases used.

Los Angeles

The 27th annual golf tournament was held at the Rancho Golf Club May 22, where 100 golfers teed off in 25 foursomes. A social hour and dinner followed, after which the prizes were awarded .

Santa Ana Valley

Four winners in the tool design contest, sponsored by Santa Ana chapter for Orange County high school students, have been announced. Dan T. Coronado from Placentia, Calif., was first-prize winner; other awards went to Robert L. Angle, Gary Ferguson, and Gary Born. Louie Boer was scholarship committee chairman.

MILWAUKEE—Chairman L. A. Wacker presents $400 engineering scholarships to Boys Technical High School graduates Thomas Manning and Thomas Buczwinski, who will attend Marquette University and the University of Wisconsin respectively. —*George Riordan*

Western Reserve

All phases of broadcasting were shown to the members of Chapter 115 when they toured WKBV radio and TV studios at Youngtown. The station's record and film libraries are the most complete in the area.

Oakland County

A special meeting featuring a golf tournament and father and son banquet, and honoring General Motors on its 50th anniversary, was held at Indianwood Country Club on June 19. Following the introduction of GM personnel by Chairman E. C. Richards, Harry E. Conrad, national executive secretary, spoke on the important part a corporation plays in the economy of a community and how the tool engineer's contribution to increased production will lead to a higher standard of living for everyone.

William Caswell conducted the GM show "Preview on Progress," a demonstration of basic scientific principles.

Binghamton

Fred Babinski, sales engineer, Ultrasonic Products Div. of Bendix Aviation Corp., spoke at the May meeting on "Ultrasonics from the Dog Whistle to the Guided Missile." He enlarged upon the history, the development, operating principles, equipment available, and applications.

Kalamazoo

A large turnout of members and guests met in June at Hammond Machinery Builders. The company, which specializes in building grinding machines, then conducted the group through the plant and demonstrated their electrolytic grinders.

Hamilton District

Fifty-five members attended the 155th dinner meeting at Brantford, where Harry Conn, chief engineer for Scully Jones & Co., spoke on "Optimation," dividing the subject into three parts, metal-cutting research, economics (covering tool changing, tool grinding cost and tool perishable cost) and advanced tool engineering. He pointed out that only 5 percent of all automatics in production in the United States today use "quick change" carbides, the point of departure for "optimation."

TUCSON—Past Chairman J. D. Beach receives certificate of merit award from Past Chairman Les Detterbeck, during technical meeting June 10. Forty-nine members present heard Robert E. McKee of the R. K. LeBlond Machine Tool Co. explain the relationship of cutting angles of tools to the horsepower requirements needed to overcome functional pressures.

Rochester

William H. Busch, manager, Floturn Div. of The Lodge & Shipley Co., spoke to 55 members at the June 9 meeting. Mr. Busch has worked closely with the development of Floturn, a precision metal forming process. His talk was supplemented with slides showing operations performed with the process.

Lima

Forty-five members heard Peter H. Mohrfeld, district engineer for United States Rubber Co., speak on "Timing Belt Drives—Theory and Application" at the May 15 meeting. Under "theory" he covered the nomenclature of belts and pulleys, their construction and materials and special construction of belt drives. Under "application," he illustrated the do's and don'ts in the use of timing belt drives.

Little Rhody

"Cerrotechnics" was the subject of a talk by O. J. Seeds of Cerro de Pasco Sales Corp. at the June 5 meeting. He showed slides on the composition, physical properties, and applications of the low-melting point bismuth alloys produced by his company.

Chautauqua-Warren

Members heard Philip W. Taylor, application engineer for the General Electric Corp., speak on "Automation" after new officers were installed.

chips and chatter

Greater New York

Speakers at the May 12 meeting were O. J. Seeds and R. S. Darnell of the Cerro de Pasco Sales Corp., who talked on the use of bismuth alloys in modern industry. Using slides, they demonstrated the various uses of the bismuth alloys and with a low-temperature melting pot they made about 50 wax-potting molds in less than ten minutes.

Elmira

Mark Twain Hotel opened its doors to members and guests of Elmira chapter at the May 12 advertisers' night, a tribute to industries that advertise in the Bulletin. Nineteen companies participated. The "Steamboat Round" roasts-beef dinner was served at seven, followed by presentation of awards for the fifth annual drawing contest.

Mansfield

J. C. Wilson, vice president of the Thompson Grinder Co., spoke to 45 members at the May 15 meeting, on "Contour and Crush Grinding Types, and Methods of Surface Grinding."

San Francisco

The chapter's first ladies night was held June 12 at Olympic Club, Lakeside, with 75 members and their ladies present. After-dinner entertainment was an "African safari," a color motion picture film.

At the May meeting, 70 members heard Glenn Stimson, sales manager and chief engineer of the Gage Div. of Greenfield Tap & Die Corp., speak on "Gages, Watchdogs, or Bandits," explaining the importance of the millionth part of an inch to industry and its production techniques. Mr. Stinson also showed slides and demonstrations of the effect of gage errors on product.

Cincinnati

On April 8 fifty members met at Engineering Society Headquarters, where Fred Bohle, manager of gear research and machine tool development for Illinois Tool Works, gave a slide illustrated lecture on 'Toward More Economical Gear Inspection."

Erie

On May 6 members gathered at the Polish Club for their technical meeting. C. N. Nieklutin, vice president of engineering for Universal Match Corp., discussed Properties of Basic Mechanisms." With the aid of slides, he showed how different mechanisms, by constant development, are improved and made more efficient for use in today's modern machines. Students from Alliance Tech and Behrend Center were given awards for high scholastic achievements during the past year.

SPECIAL EVENTS

ASTE West Coast Tool Show.
Sept. 29-Oct. 3, Los Angeles Shrine Exposition Hall.

ASTE 27th Annual Meeting.
April 18-22, 1959, Schroeder Hotel, Milwaukee, Wis.

CHAPTER MEETINGS

PLACE	Aug.	SPEAKER	SUBJECT
Detroit. Hillcrest Country Club	9		Golf stag. Other sports, contests, prizes, swimming
Santa Ana Valley. Palms Restaurant, Anaheim. 7 pm	5	To be announced	
Santa Clara Valley. Ampex Corp., Redwood City. 8 pm	19	**Arthur P. Kromer** Chf. Mfg. Engr. Ampex Corp.	Plant tour—stereo sound and Vido tape recording and reproduction demonstration
Schuylkill Valley. Swallows Club. 5:30 pm	15		Clambake
Sydney, Australia. Inst. of Builders' Hall. 8 pm	13	**Dr. Ehrls** N.S.W. University of Technology	Modern methods of manufacturing plastic products
San Gabriel, Rainbow Angling Club, Azusa. 7:30 pm	7		Father and son night; films

Position Available

ROLLER BEARING SALES MANAGER—New York Branch office of leading European roller bearing manufacturer would hire experienced national sales manager. Locate New York. Write to: Box 120, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Position Wanted

SUPERVISION OR OTHER RESPONSIBLE POSITION—desired by a graduate mechanical engineer and journeyman tool and die maker; 28 years old with eight years' diversified experience in Detroit jobbing shops, and two years' automobile production plant experience; aggressive and readily adaptable to new situations. Write to: Box 123, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Obituaries

Elmer William Burger, Denver, instructor in machinery of production laboratory, A. J. Hurt & Co.

Daniel W. Gartner, Cleveland, works manager, Columbia Vise & Mfg. Co.

Herman P. Hansli, Hartford, sales engineer, Pratt & Whitney Co., Inc.

George H. Hauser, Long Island, president, Liberty Aircraft Products Corp.

Roland Kainen, Long Island, equipment engineer, Republic Aviation.

Elmer L. Lipp, Los Angeles, founder and president of General Machine Works, Inc.

Ray Morrissey, formerly editorial chairman and public relations chairman of Detroit chapter, manufacturing engineering manager, Ford Motor Co.

Earl R. Reed, Schuylkill Valley, general foreman, American Chain & Cable Co.

Harry E. Reynolds, Muncie, vice president, Muncie Welding Co., Inc.

Emile J. Rougraff, Pittsburgh, plant manager, Thomas Machine Co.

Ray Sollman, Golden Gate, owner of Electric Novelty Works Co.

Arthur E. Watts, Ottawa, plant manager, Sun Tube Corp. of Canada, Ltd.

members in the NEWS

Louis Polk and D. W. Bronk

Louis Polk, member of Dayton chapter and a director and group executive vice president of Bendix Aviation Corp., received an honorary degree of doctor of science from Miami University at Oxford, Ohio, for his "contributions in advancing the arts of engineering, dimensional control, and metrology (science of measurement)." Mr. Polk is also president of The Sheffield Corp., Dayton, which is a subsidiary of Bendix. He is widely known in engineering and manufacturing for his key role in helping to provide industry with higher standards of accuracy in precision measurement.

In the picture above, Mr. Polk (left) talks with Dr. Detlev W. Bronk, president of the Rockefeller Institute for Medical Research, on the university campus. Dr. Bronk, who delivered the commencement address, received an honorary doctor of laws degree in the same ceremonies. He is also president of the National Academy of Sciences and former president of Johns Hopkins University.

The United States Committee for the United Nations, a privately supported citizens' organization, has picked **Michael Pinto,** Detroit chapter, to be finance chairman for Michigan engineering companies. Mr. Pinto is president of Pioneering Engineering & Mfg. Co., Detroit, and is a member of the Young Presidents Organization. The citizens committee, which works through 120 voluntary national organizations, has as its objective to keep the public up to date on operations of the UN.

Donald J. Wallace, Detroit chapter, has been elected first vice president of the Industrial Diamond Association of America, Inc. Mr. Wallace, of the Wheel Trueing Tool Co., was among those elected at the diamond association's 13th annual meeting and convention held at New York last May.

H. C. Hubbard, Lansing chapter, has authored an article published in the March issue of *Radio-Electronics*, a national technical magazine for hi-fi and TV-radio technicians and experimenters.

In his article, "New Power Source," Hubbard tells how to construct a versatile low-cost power supply for experimenting with transistors. It actually converts thermal energy directly to electric power.

Hubbard has had a wide and varied career in electronics. After graduating from high school and the Omaha Radio & TV Institute, he worked for Ohio Bell. He later attended the University of Alberta.

He is presently a tool designer—electronic design with the Motor Wheel Corp., Lansing, Mich. He has two inventions to his credit, the Hubbard oscillator and the magna-crane. He did two years of experimental work on wave propagation at the North Pole.

Curtis A. Johnston, member of North Texas chapter, has been appointed machine tool sales representative in Dallas for the Oliver H. Van Horn Co., Inc., Fort Worth. Mr. Johnston has been associated with the Huster Machine Tool Co. of Dallas for the past five years. He has been in the machine tool business since he finished his technical education in Chicago 29 years ago.

A resounding "well done"—complete with an honor scroll in tribute to his effort in both the creation and leadership of the western section of the Society of the Plastics Industry Tooling Div.—was presented to 1957 Founding Chairman **Tony Guerreiro** of Short-Run Plastics, and member of ASTE's Los Angeles chapter.

A member of the Santa Ana Valley chapter, **Harry Vance,** has been appointed west coast factory salesman by Portage Double-Quick, Inc., of Akron, Ohio. Mr. Vance's headquarters will be the firm's new west coast office and warehouse in Compton, Calif.

Recent promotions in The Cincinnati Milling Machine Co.'s management team include the appointment of **L. E. Eberts,** assistant export manager, to

L. E. Eberts

be vice president of Cincinnati Milling's sales subsidiary, Cincinnati Milling & Grinding Machines, Inc. Mr. Eberts is a member of Hartford chapter.

Max L. Overla of Dayton chapter, formerly shop superintendent for Matthews & Bartels, Inc., Trotwood, Ohio, has formed a tool-shop partnership with Don E. Mumma of Englewood, Ohio, known as Northmont Tool & Die Co. It is located in Trotwood.

3 NEW CARBIDE GRADES

VR-77...VR-75...VR-73

for Machining Superalloys and ALL Types of Steel

Here are the answers to your problems when you need cutting materials with *shock resistance*, *wear resistance* and *high heat resistance* for machining the new superalloys and all kinds of steel!

With these three carbide grades you can cover the complete machining range. All three have been carefully developed through many years of experimenting, checking and testing. Each one has the correct balance of characteristics and physical properties to handle a specific range of operations. Now they're ready for you.

VR-77 for heavy roughing and interrupted cutting
VR-75 for medium roughing and general purpose machining
VR-73 for light roughing and finish machining

Complete information on all 14 V-R Standard Carbide Grades is shown in V-R Bulletin 5803. Write for your copy or call your local representative or distributor.

MANUFACTURERS OF: CEMENTED CARBIDES, TOOLHOLDERS, AND TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

876 Market Street • Waukegan, Illinois

G-457

Progress in Production

ULTRA MODERN CORROSION LABORATORY WILL PROVIDE DATA FOR EQUIPMENT DESIGN

Something unusual in the way of research laboratories has come into being with the opening of a new corrosion research laboratory to introduce means of accurately determining corrosion rates on metals.

The large facility, established by The Carpenter Steel Co., enables the company to predict more precisely the area of usefulness of stainless and other corrosion resisting steels. It also permits thorough examination of titanium, zircalloy, zirconium and nickel base alloys.

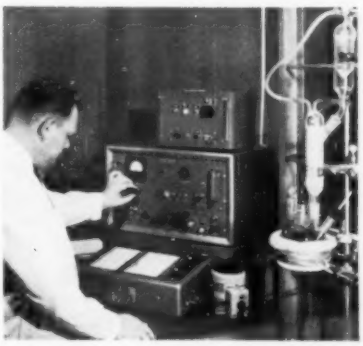
If true to expectation, studies conducted here will contribute extensively to knowledge and development of metals for critical applications in atomic energy, guided missile and aircraft fields. Such research will not only be important to fluid process industries, but will provide considerable information vital to both metalworking and metal producing industries.

Purpose of the company's expanded corrosion research program is twofold. It will develop specific information on performance and characteristics of metals so that users can make accurate selection of materials. Further, it will perform studies leading to improvement of existing and development of new corrosion resistant alloys.

Special test apparatus and methods permit corrosion rate on heat transfer equipment to be predetermined more accurately than previously possible. Resulting data will be valuable in properly designing and constructing many kinds of tubular heat exchangers.

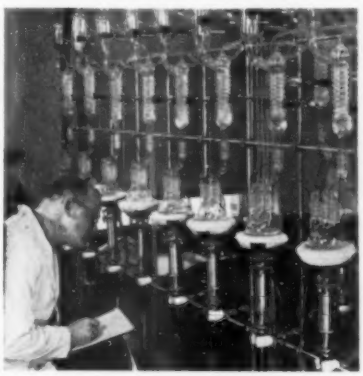
The special equipment also enables the company to get test results faster. A Corrosometer, for example, measures corrosion rates in from 24 to 48 hours. Usual methods to obtain similar results take from two to six weeks.

With its new equipment, Carpenter can compare alloys under nearly any process condition. The laboratory is equipped to work from room temperature to 1000 F, and from one-half atmosphere to 2000 psi with suitable controls



A corrosion engineer makes final adjustments on the Corrosometer—an instrument for measuring corrosion rates by changes in electrical resistance of a given specimen.

Operation of the laboratory's heat transfer test apparatus is checked by a research chemist. The lab has two banks of this equipment.



to maintain constant exposure conditions.

Considerable work is to be conducted to learn more about stress corrosion cracking in high-temperature alloys. Research will be aimed at evaluating the mechanism of stress corrosion cracking and at developing alloys with more resistance to such attack.

FINISHING SYSTEM BOOSTS PRODUCTION

Checks on production at Hoffman Engineering Co. have shown a capacity boost of 300 percent as a result of finishing changes. Reason for the improvement is charged to a conveyorized power finishing system which incorporates a three-stage washer, dry-off oven, two water-wall spray booths and a bake oven. This enables Hoffman to finish all their steel fabricated products, ranging in size from small electrical outlet boxes to 5-foot panel enclosures, automatically except for individual spraying.

Hoffman's old method of finishing involved an electrostatic spray booth, transfer trucks and batch type oven facilities requiring elaborate setups for various finishing methods used.

With the new installation, created by Despatch Oven Co., a single shift accomplishes the product finishing that formerly took three nine-hour shifts. A combination loading-unloading zone is 68 feet long. Steel hooks and clamps are used to secure the large boxes and their attached doors for travel along the overhead continuous monorail conveyor. Small parts may be mounted on racks, with as many as 16 per rack for suspension on the conveyor. Speed of the conveyor is adjustable from 3 to 9 fpm, depending on spraying time required and time-per-piece required in the bake oven.

Washer controls and bake oven controls are located near their respective units, but conveyor controls are located at the first spray booth to give the painter complete control over the system.

A three-stage washer 45 feet long incorporates cleaning and phosphatizing, plain water rinse, and chromic acid final hot rinse. Adequate drain facilities follow each rinse. A 38-foot dry-off oven may be operated at any temperature up to 450 F.

Following in the flow diagram are two 10-foot water-wall spray booths—facing opposite directions to assure maximum efficiency in over-spray dis-

DESIGNED FOR HEAVY DUTY BUILT TO TAKE IT!

O-M Series TH
Hydraulic (oil) Cylinder
2000 psi operation
3000 psi Non-Shock
available in 1½ to 8" bores
Meets JIC Standards

Every engineering and construction detail of the improved O-M Tie-rod Hydraulic Cylinder adds to its overall operating efficiency under heavy work loads, assuring maximum smooth performance with minimum maintenance. It is ruggedly constructed of heavy walled, seamless steel tubing microhoned to minimize friction. The rolled steel heads are recessed to confine the tube, prevent breathing and to provide additional protection against leakage under the most severe conditions. Heads can be rotated independently at 90° intervals for convenient port location. The piston rod is of stress relieved, high tensile steel, hard chrome plated turned, ground and polished. The rod gland cartridge that is threaded for quick, easy removal, is accurately piloted in rod head to assure perfect alignment, also serves as pilot for cylinder mounted on rod end. Rod gland contains extra long bronze rod bearing for maximum support of piston rod.

Vee type, non adjustable, self compensating, rod gland packing provides multiple lip seal. Cartridge "O" ring, with leather back up furnishes a positive seal. Rod wiper or interchangeable metallic scraper prevent dirt from entering cylinder on "in" stroke. A complete selection of mounts is available.

These and many other features are described in detail in our latest catalog No. 105. Write for your copy TODAY or consult your local O-M representative.

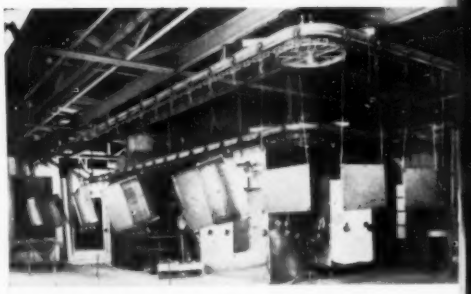
ORTMAN-MILLER MACHINE CO
13 143rd Street, Hammond, Indiana
☐ Have representative call
☐ Send Bulletin 105

Name_____ Position_____
Company_____
Address_____
City_____ Zone_____ State_____
INDICATE A-8-114

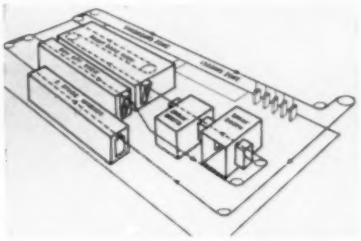
posal. This placement makes is easy for two men (one in each booth) to paint both sides of large products. Conventional primer and finish coat paints may be applied interchangeably in the booths.

Just-painted products are conveyed directly into gas fired bake oven which, although only 38-feet long, gives maximum baking-time-per-piece through three passes. Products emerging from the oven have become sufficiently cool for handling and packaging by the time they reach the unloading zone.

The overall system occupies a floor area of 104 by 44 feet with provision for future expansion of the three stage washer requiring an additional 13 feet.



Just-loaded products head into the three stage washer at left. Layout permits expanding the washer to five stages when desirable. Products return through adjacent dry-off oven, then into first spray booth in foreground.

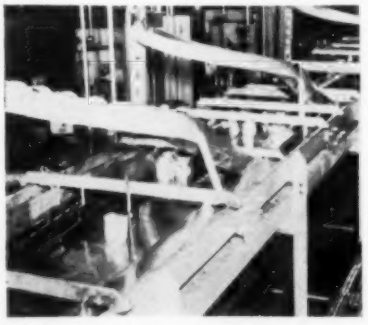


Flow diagram shows overall system. Continuous overhead monorail conveyor is 620 feet long. Three passes are made through bake oven where maximum capacity is obtained with only 38 feet length.

STEEL CONVEYOR SMOOTHS OPERATIONS

Pistons slide smoothly on a steel belt conveyor through an automated production line comprising 44 machine tools at Plymouth's Detroit Mound Road engine plant.

In handling pistons, the 360-foot Sandvik Steel belt carries castings through seven machining operations at a rate of 1200 per hour. As each operation is completed, the piston is transported vertically by flight conveyor to a spiral chute which delivers it to the steel belt. Guide bars direct it to discharge chutes leading to the next machine.



Previous belts were damaged and worn quickly by the components, and resultant downtime slowed the entire operation. The present belt slides smoothly under accumulated metal parts without damage to itself or the parts it carries.

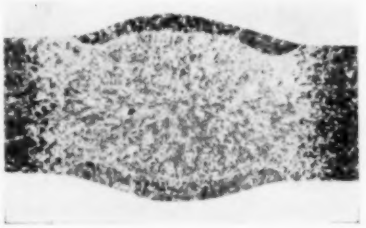
FOIL WELDING PROCESS INTRODUCED TO U.S.

Manufacturing by the foil welding process has been transplanted to the United States with the licensing of Precision Welder & Flexopress Corp. to use the Peco foil butt seam welding process.

The process, which has been used successfully in European production for several years, produces smooth, non-overlapping seam welds of dense structure and high strength at unusually high speeds according to engineers familiar with the technique. On 0.078-inch stock, for example, welds have been made at 3 to 24 fpm. Also, because it requires less heat and pressure than mash welding, there is less power demand and less warping of sheets. Mild steel, low alloy, high carbon and stainless steels all can be welded by the foil method.

In use, the process involves introducing a thin strip of foil on each side of the butt seam to be welded. Foil acts as a bridge to distribute welding current

Photomacrograph shows detail in 0.078-in. mild steel, foil butt seam welded at 144 ipm.

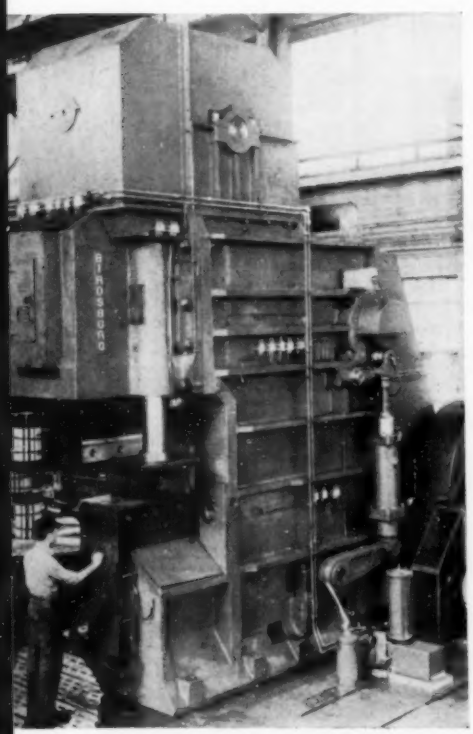


to both sheets, and also prevents heat from withdrawing too rapidly from the joint area. Added electrical resistance is provided by the foil which also helps contain the molten weld nugget while it grows in area and cools. Ordinarily sheets are clamped, and in some cases foil is spot tack welded at lower heat before being seam welded.

GIANT MECHANICAL SHEAR MAKES SQUARE END CUTS

A new 1,000-ton up-and-down cut shear will be used by an American steel producer to cut hot steel blooms up to 16 inch square, and slabs up to 6½ x 42 inches. Differing from most standard shears, cutting is accomplished by the bottom knife as it rises. This eliminates need for depressing tables or similar related equipment. A special gag or hold-down device is integrally linked to the up-stroking bottom knife during the cutting stroke. Result is a clamping action that holds work firmly in the cutting plane and produces blooms and slabs with square cut ends free from end hook.

The air clutch operated machine, designed and built by Birdsboro Steel Foundry & Machine Co., has a flywheel drive which eliminates direct drive and need for large d-c motors. A single 200 hp air cooled a-c motor operates the unit. The shear is a heavy duty cycle machine which can complete one cut in 4½ seconds.



HOW MASS PRODUCERS

Eliminate Costly, Unnecessary Metalworking Operations . . .

and produce

a better product!

7 station die ribbon for Grinnell sprinkler head.
Note: piercing, marking, blanking and forming in one press operation.
Stock: .065 brass.
Production: 72 pieces per minute.

With B. Jahn designed and engineered progressive dies, mass producers eliminate unnecessary press operations, marking operations, parts handling, intermediate inspection.

Part uniformity, product quality, production savings and profit improvement are all advantages which result in a better end product at an economical mass production price!

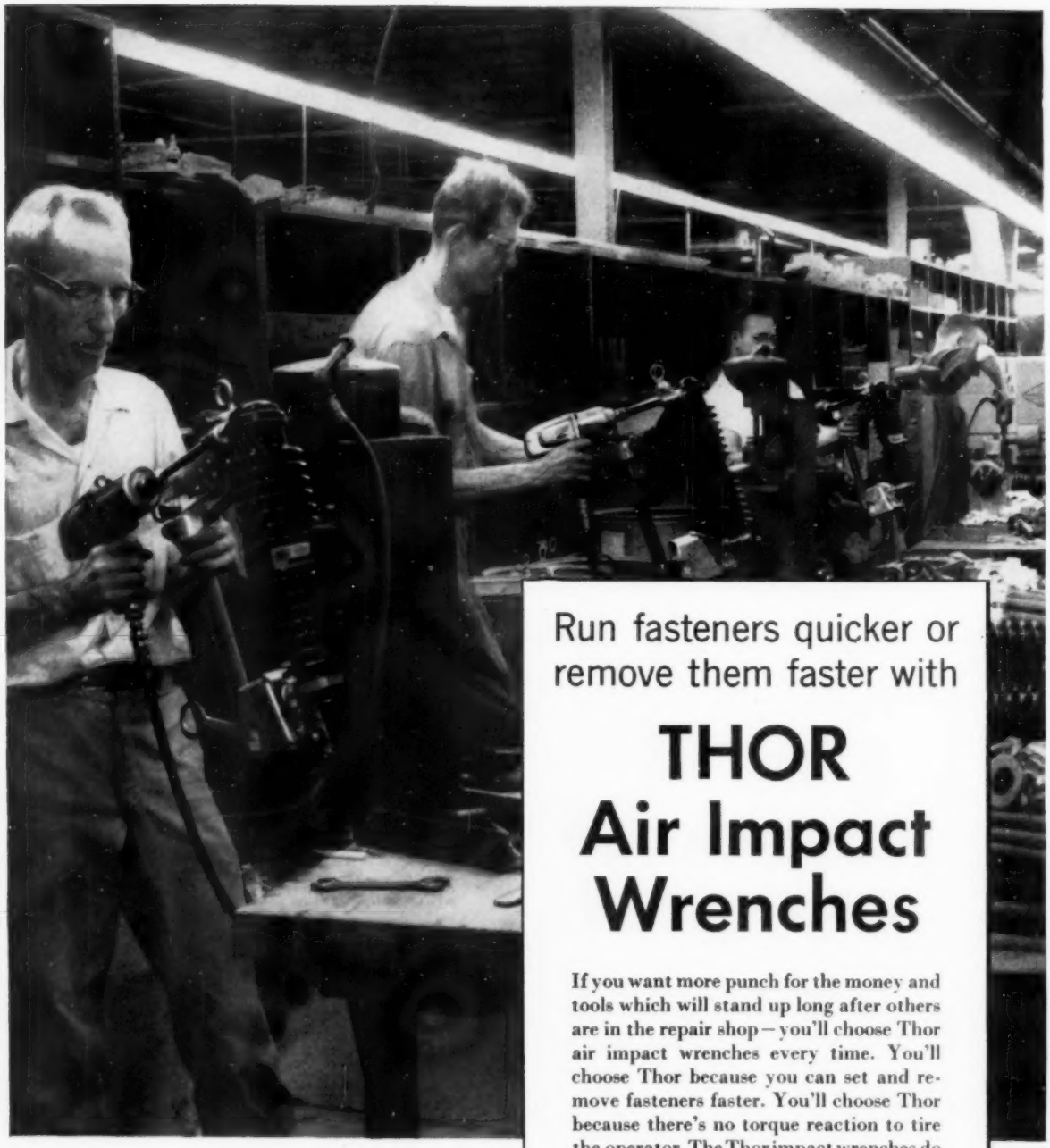
Progressive Mass Producers save with B. Jahn Progressive Dies!

B. Jahn

Send today for colorful 20 page "CASE HISTORY" Brochure!

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-115



Run fasteners quicker or remove them faster with

THOR Air Impact Wrenches

If you want more punch for the money and tools which will stand up long after others are in the repair shop—you'll choose Thor air impact wrenches every time. You'll choose Thor because you can set and remove fasteners faster. You'll choose Thor because there's no torque reaction to tire the operator. The Thor impact wrenches do the work—not the operator. And Thor gives you the widest selection of tools—¼" to 1¼" bolt capacities—a variety of angle attachments and accessories.

Get Thor impact wrenches on the job today—watch your costs go down tomorrow. Call your Thor factory representative for a demonstration. Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

THOR POWER TOOL COMPANY
CHICAGO

Atlanta Birmingham
Boston Buffalo
Chicago Cincinnati
Cleveland Denver
Detroit Houston
Indianapolis Kansas City, Mo.
Los Angeles Milwaukee
Newark Long Island City, N.Y. Philadelphia
Pittsburgh Richmond
St. Louis San Francisco
Seattle Toronto, Canada
Export Division, New York City

Thor
PORTABLE POWER
TOOLS

TOOLS of today

Inclinable Presses

Line of open back inclinable presses, called Torc-Pac O. B. I.'s features an air-friction clutch and brake as standard equipment. The clutch and brake plates are of long wearing, sintered bronze, and operate in an oil bath. Upon engagement, oil is momentarily trapped between the plates; oil molecules are compressed until the oil itself begins to transmit the pick-up load. Thus much of the pick up is accomplished before a metal-to-metal contact

of the plates take place. The clutch and brake do not require adjustment and maintenance is minimized.

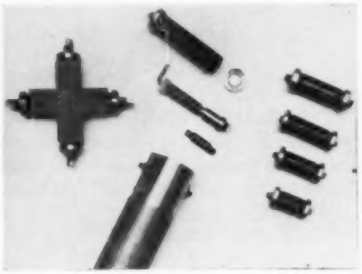
An integral drive unit, consisting of all working members of the drive and slide, can be removed from the press as a single unit.

Operating controls, including four position selector switch and run and stop buttons, are standard equipment. Except for connections to shop air line and electricity, the press is ready to run when shipped. Torc-Pac presses are built in capacities of 22, 32 and 45 tons.

Clearing Machine Corp., Div. of U. S. Industries, Inc., 6201 W. 63rd St., Chicago 38, Ill. **T-8-1**

Double Feed Boring Bar

Two or more diametrically opposed Sure Bore cartridges and tool bits, each micrometrically adjustable, are employed in this tool to provide faster boring feed without increasing tool wear. Counteraction of opposed tool pressures eliminates most of the spring in a bor-



ing bar, thereby assuring regularity of resultant bore size regardless of variations in stock removal and with minimum chatter and out-of-roundness. To back bore the unit, the boring bar is reversed.

This double feed unit is simple to use, and covers a wide range of bore sizes within each size unit. Little machining is required to provide a boring bar which will use it.

Portage Double Quick, Inc., 1035 Sweitzer Ave., Akron 11, Ohio. **T-8-2**

Layout Drilling Machine

Numerical positioning control has been applied to the standard layout drilling machine which is designed as an accurate drilling and boring ma-

chine for toolroom work and medium to small lot production runs. The numerical system receives necessary positioning instructions from the tape and converts them into machine operations. Once a workpiece has been clamped onto the table, it is automatically positioned under the spindle to successive hole locations as machining operations are completed. Table and carriage coordinate locations can be programmed in a definite sequence established to give optimum efficiency.

Hole location positioning is accurate to ±0.001 in 12 in., while repeatable positioning is accurate to ±0.0005 in. Smallest increment of positioning information is 0.001 in. Maximum positioning speed is 60 ipm and maximum number of positioning cycles is 20 per minute.

Preparation of a punched tape is ac-

complished in minutes. Setups are made easily, and since only locating stops or a simple holding fixture is needed for the most complex workpiece, loading and unloading time is minimized.

Because machining need not be stopped to make periodic measurements and adjustments, productive operation is nearly continuous. Human error is minimized with consequent reduction of production of scrap. The machine is so nearly automatic that many jobs permit one operator to attend two machines.

Procedure for preparing the tape is simple and inexpensive, and does not require the use of a computer. It can be handled in any plant without changes in operation methods. By inserting a tape into the reader for each different workpiece to be produced, the layout drilling machine can be quickly converted from one machining task to another. Tape used to supply input data to the machine is standard, one inch in width with eight channels. The tape punch automatically converts standard decimal dimensions into a simple code. Numerical information for controlling movements and auxiliary functions can be read in any sequence.

Design of the numerical control also permits the operator to position the machine by means of manually setting up decimal dimensions on dials located on the control console. Each successive hole location may be preselected with the digital dials while machining is in process. Dialing input dimensions is especially useful for prototype work and single piece production. Several auxiliary tape controlled functions are available to aid machining.

Cleereman Machine Tool Corp., Green Bay, Wis. **T-8-3**

Epoxy Molding Compound

High strength is coupled with unusual conformability in Scotchply brand high-strength reinforced epoxy resin molding compound type 1100. Average flexural strength is 100,000 psi, average tensile strength is 40,000 psi, and average compressive strength is 38,000 psi at normal temperatures.

Because of its ability to flow, and the tendency of its fibers to distribute evenly under pressure, the product is particularly suitable for making complex parts which previously required hand layup or machining.

The material is supplied in dry form, and is adaptable to either compression or transfer molding processes. Even with its high glass content of 66 percent, conformability is excellent, and "fiber flow" is good. Resin content is 34 percent by weight. Uniformly high strength is obtained by consistent resin distribution and fiber length.

The compound has a bulk factor of 15:1, which is readily reduced to 2:1 by hand pressure during the die loading cycle. It is usable in standard equipment without modification.

Minnesota Mining & Mfg. Co., Dept. F8-160, 900 Bush St., St. Paul 6, Minn. **T-8-4**

Grinding Fixture

With the Roto-Grind rotary table fixture for surface or jig grinder the table turns under the wheel to facilitate fast, accurate work.

The fixture may be used vertically or horizontally for either external or internal grinding of holes, radii, contours or inside steps. Height of the unit is $5\frac{3}{4}$ in.; diameter is $10\frac{3}{8}$ in.

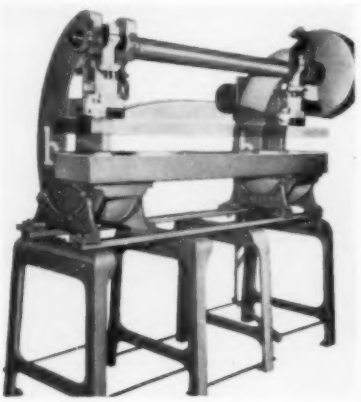
M-M Tool Mfg. Co., Roto-Grind Dept., Dayton 2, Ohio. **T-8-5**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Multiram Press

A combination press is useful to manufacturers doing stamping, forming or trimming operations on relatively large material of light gage or soft composition. It serves equally well used on rubbed sheets, cloth, cork, plastics, and some light gage metals or foils.

The two presses in the unit are of 8-ton capacity, both rams operated simultaneously by means of a shaft equipped with universal joints at each end. Because only one flywheel is used, total capacity remains at 8 tons.



Center to center distance between rams is 45 in. and will accommodate coil or sheet stock up to 37 in. wide between press-frame members. A special 3 in. thick bar bolts between both rams and is reinforced by two curved ribs extending from one inner ram face to the other.

Different stock width openings and ram center distances are available.

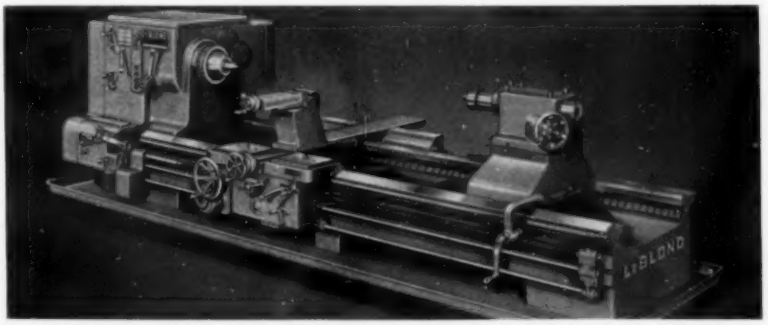
Benchmaster Mfg. Co., Gardena, Calif. **T-8-6**

Lathes

Two big-swing, relatively light horsepower lathes, available with up to 50 hp, afford unusually large swing to turn large cylindrical, tubular and fabricated parts.

The models, designated General One-75 and Admiral Two-120, incorporate wide bed designs to assure that cutting force is properly absorbed into the bed.

The General One-75, illustrated, incorporates an extra-wide bed and carriage and swings up to 75 in. The Admiral Two-120 features double-bed construction (two beds integrally cast in



parallel) and is currently designed to swing up to 120 in., with center distance as required.

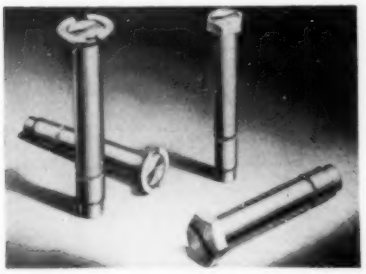
Tracing — either Hydra-Trace, two-way duplicating attachment or 90 deg tracer — is available on both machines. Both lathe designs can be adapted both in swing size and power requirements to suit individual needs.

The R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. **T-8-7**

Blind Fastener

This removable and reusable blind type high-strength shear fastener, called Sleev-Lock, can be inserted, tightened up and later removed from an assembly with an inexpensive attachment to a power tool.

Additional features of the fastener include single tool installation, rapid installation rates (up to 35 assemblies per minute), and preassembly of the fastener parts. They conform with NAS 1059 specification for high-strength blind fasteners, and there is no waste



or throwaway metal on initial installation.

The fasteners are available in a size-for-size substitution for high-strength shear bolts in existing designs.

Sleeve-Lock is a three-piece, preassembled unit consisting of outer sleeve and expandable nut with a core bolt running through the two. The nut engages the end of the core bolt. Two different configurations each have their own power tool attachment. The 100-degree flush head Sleev-Lock has an outer sleeve with two shallow slots in its head—180 degrees apart. The protruding type Sleev-Lock has a sleeve with hexagon head which is engaged and held stationary during driving by a corresponding hexagonal socket in the power tool attachment. Core bolts for both types are 100-degree flush heads with Hi-Torque wrenching recess.

To remove a Sleev-Lock, the drive is reversed to withdraw the core bolt. Both sleeve and core bolt can then normally be used with another nut. The bolts can be driven into undersized holes where desired.

Standard Pressed Steel Co., Jenkintown, Pa. **T-8-8**

Drilling-Tapping Machine

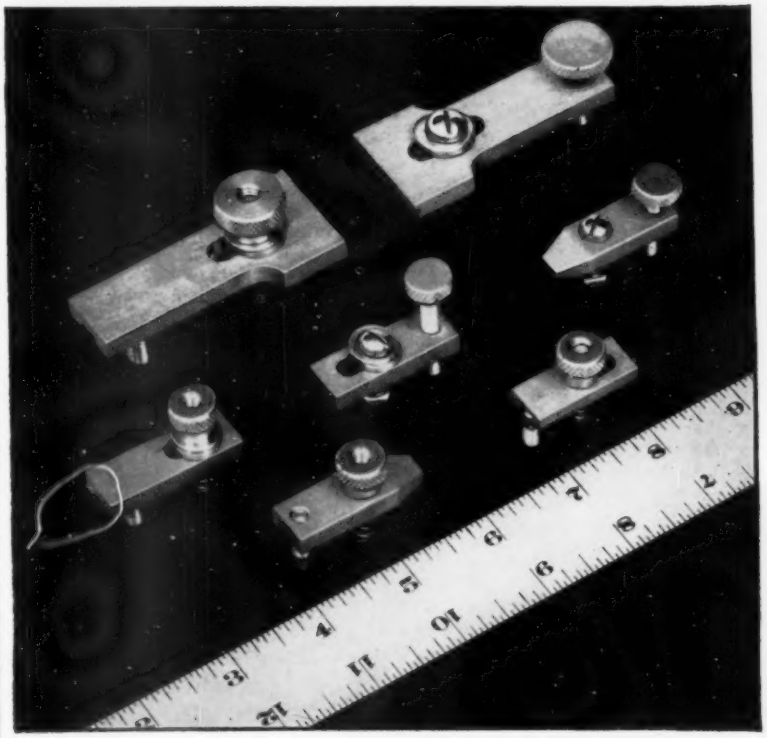
A multiple spindle machine drills and taps simultaneously achieving production of 400 parts per hour. It is available with 16 or 24 spindles. Half of the spindles, located on one side of the head, are used for drilling, and are driven by a standard electric motor. Those on the other side are driven by a high-reversal-duty hydraulic tapping motor.

Loading is accomplished during machine operations; unloading is automatic as parts drop down a chute. During processing, parts are located and held by spring-loaded locating pins. A rotating table can be used to maintain high production rates where operations are such that additional locating or clamping means are necessary.

This machine, which can be adapted to general purpose use at any time by substituting adjustable arm type spindles for the slip spindles, also may be obtained for step drilling, chamfering, counterboring or spot facing.

In the machine illustrated, the table

LODDING'S LITTLE FELLOWS



The Lodding line of stainless steel fixture components and clamp assemblies is complete and ready for you at your nearest Lodding warehouse. Carefully designed and made for essential holding in miniature operations . . .

- **Chisel Point Assembly . . .**
- **Wide Clamp Assembly . . .**
- **Knob Assembly . . .**
- **Thumb Screw Assembly . . .**

LODDING, INC.
WORCESTER 1, MASS.

Goodwin-Snader Co.
6814 S. Western Ave.
Los Angeles 47, Calif.
PLeasant 3-1553

FACTORY WAREHOUSES

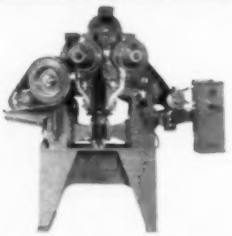
Bagby Engineering Co.
1047 Forest Ave.
Evanston, Ill.
AMbassador 2-2273

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-119

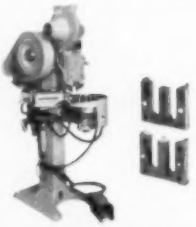
Speed up **RIVETING** and **CLINCHING**

Automatic feeding and setting with

T-J



RIVETS 4 AT A TIME! Special quadruple riveting unit, incorporating two Model "RR" Twin Rivitors, mounted on a special welded steel base. Equipped with air-operated hold down mechanism and a safety air trip arrangement. Tooled for riveting left hand and right hand automotive muffler bracket assemblies.



SPECIAL TWIN RIVITOR! Tooled for 6 station indexing fixture, incorporating automatic clamping and ejecting mechanisms, for riveting laminated armature assemblies.

T-J CLINCHOR adapted to a wide range of clinch nut setting problems. Gravity Feed model shown here.

You'll realize *faster assembly . . . reduced labor costs* immediately, when you use T-J Rivitors and Clinchors for your production line. These performance-proved machines are designed to do a wide range of assembly jobs for aircraft, automotive, farm machinery—riveting jobs of *all* kinds.

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to ⅞" long. Throat depths 8" to 36".

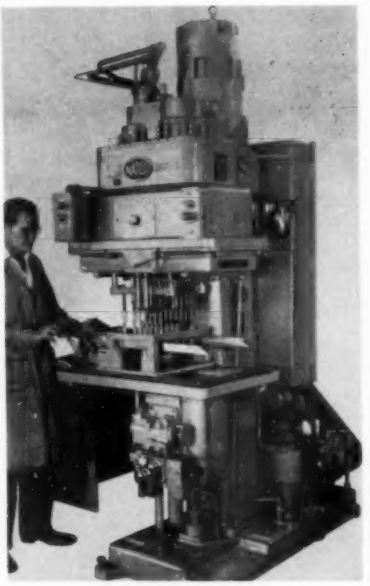
T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity Feed models, throat depths 8" to 36".

Send today for these helpful references: Rivitor bulletins 646 and 555 . . . Clinchor bulletin 555. The Tomkins-Johnson Co., Jackson, Mich.

T-J **TOMKINS-JOHNSON**

RIVITORS, AIR AND HYDRAULIC CYLINDERS, CUTTERS, CLINCHORS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-120



moves up and down hydraulically—rapid traverse up, feed up, feed down, and rapid traverse down. Two feed rates may be used, with automatic change if needed. The same spindles used for drilling also may be used for tapping by turning a knurled ring which provides a half-inch float.

Individual spindles have both high and low speeds. Speeds can be adjusted by changing the main drive speed.

National Automatic Tool Co., Richmond, Ind. **T-8-9**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Optical Gage

An all-purpose Bausch & Lomb DR-25 (direct reading) optical gage measures depth, thickness, height, and diameter, Measuring range is continuous from 0 to 3 in., with no masters or set gages

needed. Measurements are read directly on an illuminated, magnified scale graduated in clearly defined least-reading intervals of 0.0001 in, with an accuracy of 0.000025 in.

The extra-large worktable facilitates adaption of special fixtures; however, most parts need merely be laid on the anvil, which has flatness accurate to 0.000005 in. for measurements to be made. A turn of the control knob lowers the spindle until it touches the part. The spindle stops automatically on contact and the accurate measurement is immediately readable on the scale.

Bausch & Lomb Optical Co., 76349 St. Paul St., Rochester 2, N. Y. **T-8-10**

Saw Sharpener

Circular saws up to 16 in. diam, band saws up to 2 in. wide and hack saws up to 2 in. wide x 24 in. long can be sharpened on this combination saw sharpener. A master indexing arrangement makes it possible to cut in new teeth with accurate concentricity or change number of teeth to more or fewer per inch. It can be converted to any of the three different uses in a matter of minutes. Each attachment is automatic.

Hamco Machines, Inc., 99 Mt. Hope Ave., Rochester 20, N. Y. **T-8-11**

Pneumatic Presses

Two high precision pneumatic presses for all types of production and assembly operations are PH 2, with a force of 500 lb, and the PH 3 which exerts 1700 lb. Both machines operate on 85 lb air line pressure.

A micrometer depth stop with an accuracy of 0.0001 in. is built into the presses. Length of stroke is adjustable from 0.004 to 1.18 in. Ram speed is set by a variable control which does not alter applied force.

The PH 3 allows independent settings for separate downward and upward stroke speeds.

Bases have T-slots to simplify fixture mounting. Applied pressure of both machines can be reduced by lowering air line pressure.

American Lip Corp., 610 Fifth Ave., New York 20, N. Y. **T-8-12**

Multispindle Copying Lathe

On the Model 412/25 four-spindle copying lathe, work is chucked between centers; both the driving spindles and tailstock centers then are indexed together through the work positions.

Copy turning is performed by template-operated hydraulic copying slides which can be mounted at the three work stations. For additional operations forming arms and/or cross slides can be

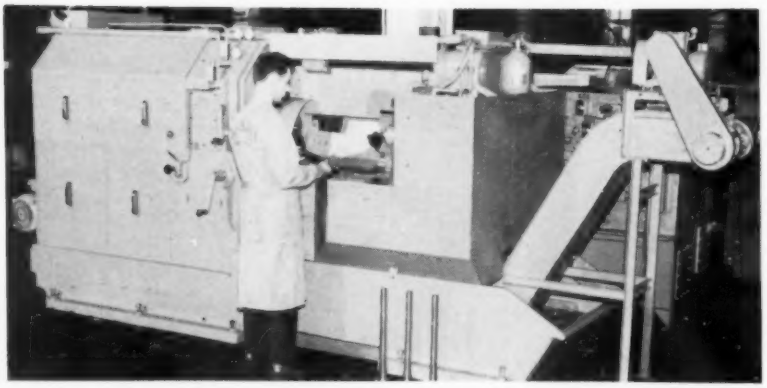
Save Time and Tools on the Big Jobs
PUTNAM
POSTIV-LOK
END MILLS
Putnam takes the shank off the end mill . . .
. . . puts it on a holder that soon pays for itself.
Postiv-Lok adapters simplify change-over to small end mills, shell end mills and drills.

Eliminate integral tapered shanks and cumbersome tool changing on heavy end mill jobs with the new, proven Postiv-Lok end mills. They'll cut your end mill costs up to 25%, give smooth, chatter-free cutting through torque-aided locking. Write for catalog on your letterhead.

Putnam Distributors from Coast-to-Coast carry large stocks of standard end mills. Contact your neighbor, the local Putnam Distributor, he will recommend the best end mill for specific jobs, give you personalized service, and quickly supply your needs with the finest end mills obtainable.

PUTNAM TOOL COMPANY
2981 CHARLEVOIX AVENUE · DETROIT 7, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-121



mounted at the same work stations. An infeed or necking slide also can be added at the number one, or loading station.

The copy-slides have a 12½ in. longitudinal stroke and are positioned to suit the job. Turning capacity is 7 in. Spindle speeds from 300 to 1500 rpm are available and are changed by pick-off gears, while all slides have infinitely adjustable feed rates.

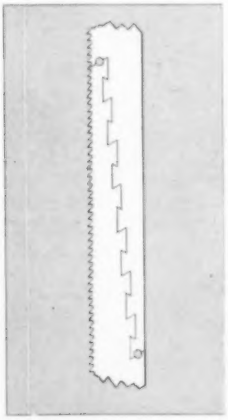
Because operations are performed with the work mounted between the same set of centers, concentricity of all diameters is assured.

The New Britain Machine Co., New Britain-Gridley Machine Div., New Britain, Conn. **T-8-13**

Detachable Band Saw Blade

This band saw blade because it simplifies internal sawing can be securely joined or taken apart in seconds without damage. Dovetail notches interlock to take the longitudinal tension.

Holes where the ends join have internal V-grooves and the ends are locked in place by inserting soft metal balls into the holes and flattening them



to the band thickness with pliers, thus causing them to expand and fill the V-grooves. All teeth and the entire band retain the original hardness and temper.

This manner of fastening assures alignment. The band is taken apart by hand when the tension is removed by bowing the sections of the splice in opposite directions.

Davies Product Engineering Co., P. O. Box 216, Fraser, Mich. **T-8-14**

Turret Drill

Particularly adaptable to high production jobs, the floor model turret drill will drill, tap, counterbore, ream or otherwise machine holes up to ¼-in. diam in steel.

A series of six different operations can be performed from one work location with a six-station turret. The turret is power indexed, rotates itself, and only the spindle in use is in operation. As the head reaches top position on the vertical columns, indexing is triggered automatically. Each spindle, however, will repeat any number of feed strokes without indexing.

For maximum cutting efficiency on every spindle over a wide range of drill sizes, each spindle operates at its own preselected speed, without need for changing belts, gears or other speed reducers. Range varies from 350 to 6200 rpm. Sequence of spindle speeds is arranged so that a manufacturer can automatically index from center drilling, to drilling, to tapping, all at correct rpm's for each tool without skipping stations. Spindle sequence is interchangeable. Two-step pulleys on the motor drive produce two complete speed ranges on each spindle.

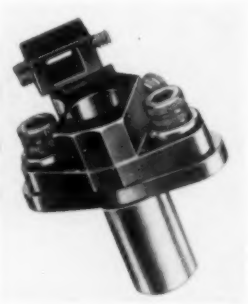
The tool is mounted on an enclosed pedestal equipped with a coolant system.

Small Tool Div., Burg Tool Mfg. Co., Inc., 13226 S. Figueroa St., Gardena, Calif. **T-8-15**

Screw Machine Accessory

Combination drill and turning toolholder for screw machines can be used: to add a light turning or facing operation when the turret is full; to provide a chamfer or sizing turn combined with a drilling or reaming operation; for operations where combined cuts can save time and money.

This durable and accurate combination holder can be used for either right hand or left-hand turning operations, and little or no clearance is required. The drill head is adjustable for centering the drill on the work; the tool slide is adjustable for length. Three sizes are



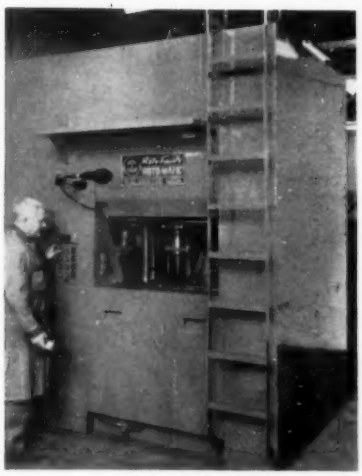
supplied—for Brown & Sharpe No. 00, 0 and 2 machines. The toolholder for No. 00 machine accommodates 5/16 x ¼ in. tool bit and ⅛ in. diam drill shank; holder for No. 0 machine accommodates 5/16 in. square tool bit and 7/16 in. diam drill shank, holder for No. 2 machine accommodates ⅜ in. square tool bit and ¾ in. diam drill shank.

The American Cam Co., Inc., P. O. Box 2106, Hartford, Conn. **T-8-16**

Finishing Machine

Used primarily as a deburring unit, the Roto-Matic is useful for polishing and surface improvement, microfinish of the order of 3 to 4 rms, and stress relief. Deburring and polishing also can be done on the inside diameters of parts, such as inside gears and hydraulic pistons.

The machine uses a fine abrasive media—normally between 8 and 14



mesh—for high polishing and surfacing results. During normal deburring time cycle the machine eliminates stress risers in the metal. Metal stresses, often built up in parts that have been previously ground, are relieved. A single operator, working from one control station, can operate the Roto-Matic from the pushbutton control panel.

Roto-Finish Co., Kalamazoo, Mich. **T-8-17**

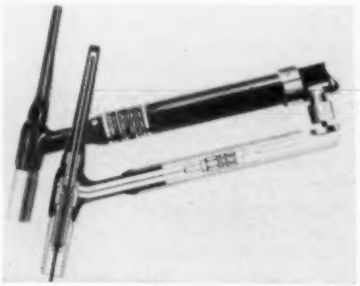
USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Welding Torch

This HW-18 Heliarc hand-welding torch has cooling water passages molded in the torch head, which assures freedom from leakage. The torch body is made of Fiberglas-reinforced phenolic with exceptional heat resistance. Gas cups for the torch are designed for thermal shock and heat resistance, with impact strength four times greater than conventional cups. For exceptionally hard use, metal sleeved cups are available.

The torch weighs 7 ounces. Improved design of collet bodies gives efficient argon shielding. Optical shut-off valve is on the handle. Collets, collet bodies, cups and caps are interchangeable.

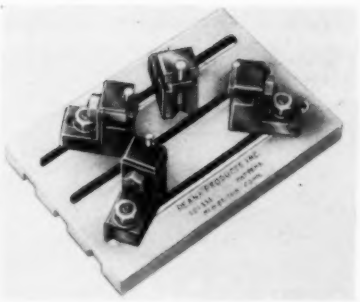
Linde Co., 30 E. 42nd St. New York 17, N. Y. **T-8-18**



Adjustable Gage

This multihole location gage permits adjustment to allow inspection of almost any shaped part. The Holocator unit consists of a 4 x 6-in. precision ground base plate, pinholders and pin clamping yokes.

Pins which measure sizes and locations of holes in the workpiece are supported by pinholders which can be adjusted to position when attached through slots in the gage base. The pins



PRECISION
...Our Key To Your Quality
In Combination Center Drilling
OLD STANDARD LETTER DRILLS
HI-SPIRAL CENTER DRILLS
NEW STANDARD NUMBER DRILLS
ALL THREE in Regular, Arbor or Bell Type

CIRCLE R precision underwrites your precision by holding close tolerances. Our center drills include always-popular old standard letter drills, new standard number drills, and our Hi-Spiral drills.

On drilling problems, get in touch with Circle R specialists.

BURBANK · CHICAGO · CLEVELAND · DAYTON · DETROIT · HACKENSACK · INDIANAPOLIS · MILWAUKEE · NEW YORK CITY · PHILADELPHIA · MONTREAL · PHOENIX · PITTSBURGH · PROVIDENCE · ROCHESTER · ST. LOUIS · WESTBURY, L. I.

SEND FOR CATALOG O

634-7

CIRCULAR TOOL CO., INC.

PROVIDENCE 5, RHODE ISLAND

Specialists in Circular Cutting Tools Since 1922

METAL SLITTING SAWS · COPPER SLITTING SAWS · SCREW SLOTTING SAWS · COMMUTATOR SLOTTING SAWS · JEWELERS SLOTTING SAWS · CUT-OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS · COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-123

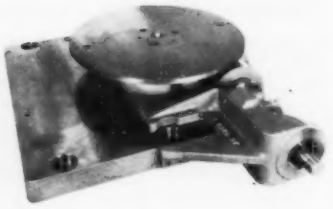
may be spaced by sample, template or micrometer.

Reana Products Inc., Box 555, New Britain, Conn. **T-8-19**

Dial Feed

A high-speed, precision dial feed with integrated bolster plate is available for OBI presses up to 60 tons. The accessory, called Bolster-Matic, is designed to facilitate rapid change of setups. Dial and dies may be removed as a unit or the entire index table with dies and bolster may be easily detached from the press for die setup, etc., at a work bench.

Indexing, accomplished by a roller gear drive, is accurate to 0.001 in. and is rated for a minimum of 8,000 hours precision operation. A modified trapezoid acceleration characteristic assures smooth operation. The dial feed is synchronized with the press and powered by either a chain and sprockets or drive shaft connected to the main crank shaft with a 1:1 ratio. Protection to both the indexing mechanism and the press is provided by a safety clutch which stops indexing and actuates a switch to turn off the press in event of a jam.

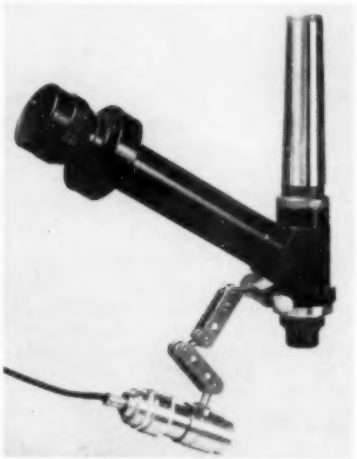


Standard feeds are provided with 4 to 24 stations, from 120 to 270 deg feed times and rated for speeds up to 200 strokes per minute.

Ferguson Machine Corp., 7818 Maplewood Industrial Court, St. Louis 17, Mo. **T-8-20**

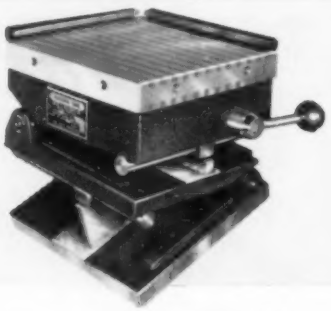
Jig Borer Microscope

This instrument, designed as a locating microscope in jig borers and similar precision machine tools, affords 25x total magnification over a fairly large field. The eyepiece contains a hairline cross and is adjustable for individual focusing. Standard shanks are ½ in. straight, No. 2 and No. 3 Morse taper. A flexible spot illuminator is available for independence from shop lighting conditions.



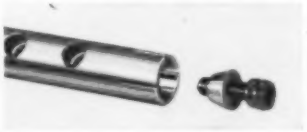
Made by Leitz-Wetzlar (West Germany) and distributed by Opto-Metric Tools, Inc 137 Varick St., New York 13, N. Y. **T-8-21**

WHY *Robbins* IS YOUR BEST BUY



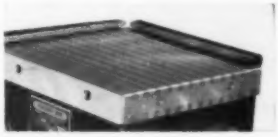
Only Robbins angular tooling equipment assures you positive accuracy when setting up to machine, grind or inspect angular work . . . because only Robbins gives you these exclusive features:

POSITIVE LOCKING locks firmly inside sine bar roll with expanding action for positive lock. Screw at each end locks toward front of unit, always pulls upper member firmly down on gage block without distortion. (Pat. app. for)



"PERMA-FLAT" SWIVEL BLOCK contacts gage block over entire face of swivel block instead of on a single thin line of contact. This patented feature provides greater contact between gage block and unit . . . combines with Robbins positive locking to assure the utmost accuracy.

FINE POLE ceramic magnet chuck, manufactured for Robbins by famed O.S. Walker Company, Inc. Strongest magnetic chuck available. Fine poles make it easier to set up smaller work, go right to the edge for easier setup next to rails.



IN ADDITION, both magnetic and non-magnetic models are built with ribbed base, intermediate and top plates for distortion-free strength and rigidity, with full-length ground roll seats for precision location, greater accuracy. All models make it possible to set up any angular work in just four simple steps . . . in minutes instead of hours! Before you purchase any sine plate, be sure you check Robbins' exclusive features. Write for new catalog!

OMER E. *Robbins* COMPANY
11961 DIXIE AVENUE DEPT. E DETROIT 39, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-124

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hydraulic Presses

Hydro-Dynamic press line now includes low tonnage gap frame hydraulic designs that range from 10 to 100-ton capacity models.

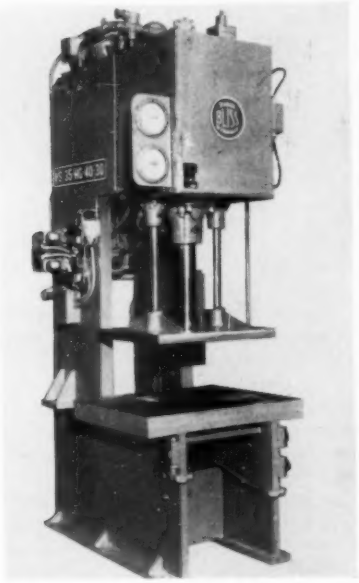
Designed for high-speed operation, the presses have quick advance speeds, slowed pressing speeds and rapid returns. Because of their large bed areas, they can handle a wide range of part sizes and shapes. Press stroke is long and adjustable to any point in its length.

Frame design is of stress-relieved welded steel construction. Special brack-

ets are mounted on the frame so the presses can be lifted by fork truck and relocated quickly. To facilitate crane lifting, small holes are placed near the top of the frame.

Both presses are equipped with Bliss electric controls which are actuated by two pushbuttons. The operator must press both buttons, and therefore cannot have his hands in the die space.

The presses are fast acting. The 10-



ton model has an advance speed of up to 530 ipm, a pressing speed of 216 ipm, and a return speed of 442 ipm. Over-all height of the machine is 106 in.; floor space requirements are 30 x 45 in. The 35-ton press (illustrated) has quick approach and rapid return speeds of 693 ipm and a pressing speed of 100 ipm. Its over-all height is 110 in. and it occupies 40 x 55 in. of floor space.

E. W. Bliss Co., 1375 Raff Rd., S. W., Canton 10, Ohio. **T-8-22**

Vertical Profiler

A tracer control for automatic 360 deg profiling incorporates spark gap sensing elements. The machine, called the Magnespark profiler, operates from a sheet steel profile template to produce any two-dimensional straight-line or irregular contour shape at speeds up to 60 ipm.

It can trace at a preset constant surface speed, thus producing good surface finish, as well as assuring long cutting tool life.

Unusual tracer sensitivity coupled with backlash-free drives to the table and spindle slide results in precise accuracy. Because of sensitivity of the

LepeL

HIGH FREQUENCY INDUCTION HEATING UNITS

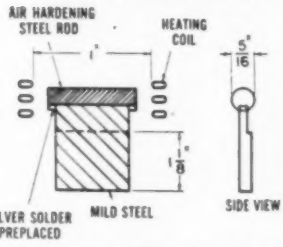
BRAZING SOLDERING HARDENING ANNEALING BOMBARDING MELTING

The Lepel Line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

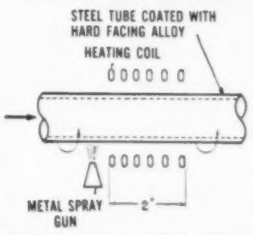
TYPICAL INDUCTION HEATING APPLICATIONS

SIMULTANEOUS HARDENING and BRAZING

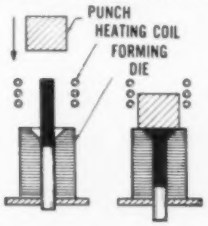


The machined and finished rod of air-hardening steel is simultaneously hardened and brazed to a mild-steel tab. Use of a purified hydrogen atmosphere and a high temperature brazing alloy permits successful hardening of alloy steels without discoloration and scaling even in the absence of flux.

DIFFUSION BONDING OF SPRAYED METAL COATINGS



Corrosion or wear resistant metal coatings sprayed on metal surfaces can be improved by heating to achieve alloying by diffusion. The drawing shows a typical arrangement for processing steel tube sprayed with hard facing alloy. Long tubes may be progressively sprayed and heated.



HEATING HIGH STRENGTH ALLOYS FOR FORMING

Uniform and rapid heating of high strength alloys (alloy steels, titanium, etc.) aids in upsetting and forming operations and also minimizes oxidation and embrittlement.

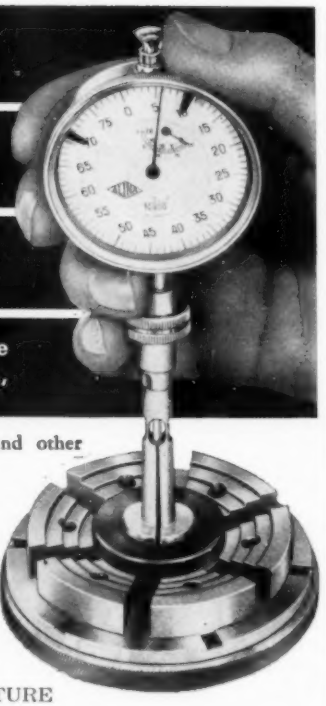
Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-125

ALINA BORE TEST



High Precision Small Bore Gage
Dial Graduated to Read .0001"

Indicates taper, bell mouth, out-of-round and other dimensional variations of bores ranging in size from .057" thru .810". • Simple design and rugged construction are combined to provide a reliable instrument that will always repeat. • 3 sets cover complete range; each set fully equipped with rings and measuring heads. • 2 different holders are available for production applications.

ALINA WRITE FOR LITERATURE

ALINA CORPORATION

122 East Second St., Mineola, L.I., N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-1/2

INSERT CHASER **H&G** DIE HEAD

FOR LESS THAN $50 YOU GET 12 SETS, EACH SET GROUND READY TO GO

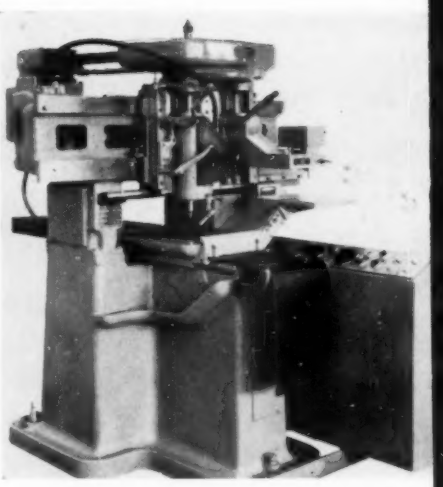
Men would not accept either idea at first . . .

INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than $50 you get a dozen sets of ¾—16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime. FREE: "Unified and American Screw Thread Digest"

THE EASTERN MACHINE SCREW CORPORATION, 27-47 Barclay St., New Haven, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-126-2



two spark gap pickups in the tracing head only 0.0002 in. stylus deflection is necessary to activate the table and slide.

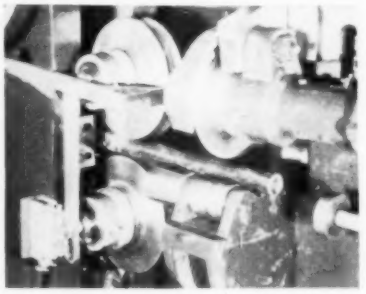
Simple tooling, as well as zero tracer pressure permit use of soft steel templates without wear.

Automatic cycling can be used where quantity production is involved. Control cabinet to the profiler is wired to accommodate automatic cycling components conveniently.

Pratt & Whitney Co., Inc., West Hartford 1, Conn. **T-8-23**

Accessory for Pipe Cutoff Machines

Two to four of these automated rotary pipe and tube cutoff machines with automatic feed can be operated simultaneously by a single attendant. The operator loads the rack with from 15 to



25 lengths of pipe up to 21 ft long. The machine will automatically feed, and cut the pipe to the predetermined length required.

Adjustments can be made quickly for cutting pipes from ⅞ to 3½-in. OD. The automatic feed section also is available in models to fit cutoff machines other than Continental.

In operation, a length of pipe is automatically lifted from the rack into sup-

port forks, pushed into feed rollers that convey the pipe to an automatic stop gage and cutting action starts. Air cylinder pusher, feed rollers, and cutter are electronically coordinated.

Continental Machine Co., 2345 W. Nelson St., Chicago 18, Ill. **T-8-24**

Countersinking Attachment

Positive depth control in hard-to-reach places is provided by the microstop angle countersink attachment which fits all Zephyr 90 deg standard duty angle drills. An indexing ring, adjustable in

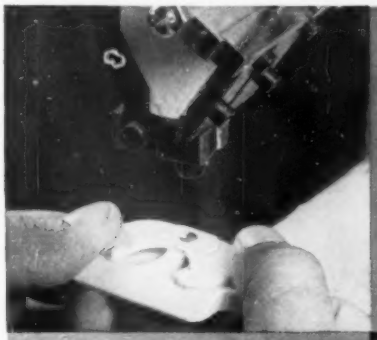
increments of 0.001 in., permits an operator to increase or decrease cutting depth, and a positive locking device fixes the countersink cutter position once the proper depth has been determined. Adjustments are made with finger-tip control.

Zephyr Mfg. Co., Inc., Sales Div., Inglewood, Calif. **T-8-25**

Mechanical Indicator

The Super Compar-It gaging head provides constant measuring pressure and practically frictionless movement of all moving parts. Graduations of the instrument are in 20 millionths of an inch; and dial ranges are from ±0.001

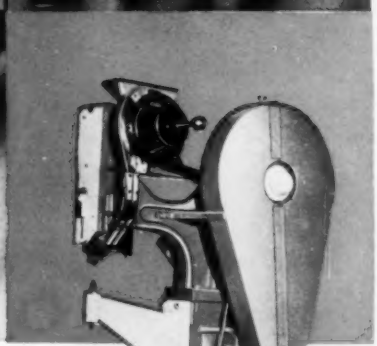
HERE'S HOW A MILFORD RIVETER CUTS PRODUCTION COSTS, SPEEDS ASSEMBLY AUTOMATICALLY!

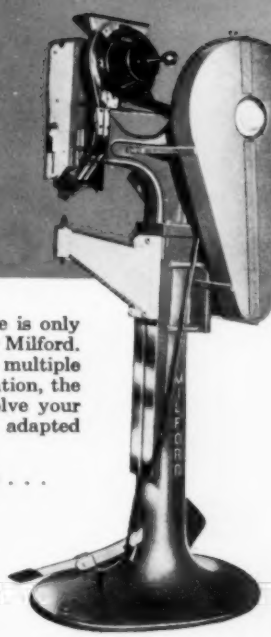


The operator places the parts over the roll set plunger. A tubular rivet has dropped from the feed rails into the jaws.

As the operator trips the machine to begin the cycle, the jaws and driver automatically carry the rivet down to the work.

The rivet contacts the roll set plunger. The spring-loaded plunger recedes, guiding the rivet through the assembly where it is clinched on the underside.





The floor-mounted Riveter shown here is only one of a full line of automatic riveters by Milford. Bench or floor models . . . single or multiple spindle . . . manual or automatic operation, the Milford Riveter line is designed to solve your toughest assembly problems, can be adapted to your particular operation.

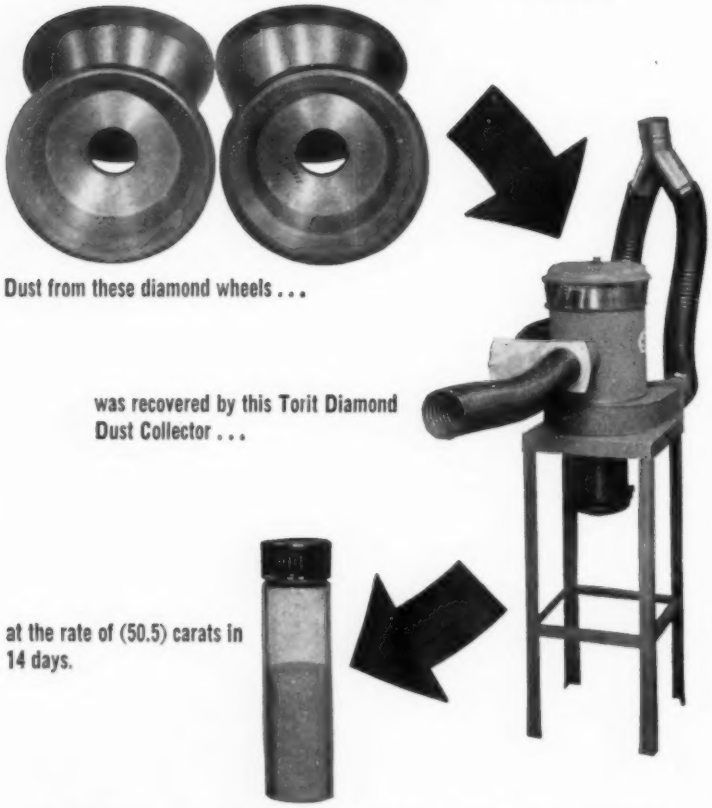
For a complete line of tubular rivets . . . for fast, trouble-free assembly . . . look to Milford!

THE MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNSYLVANIA
ELYRIA, OHIO • AURORA, ILLINOIS • NORWALK, CALIF.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-127

NEW TORIT DIAMOND DUST COLLECTOR SAVES YOU UP TO 30% OF CARAT USAGE; COSTS ONLY $178.50!



Dust from these diamond wheels . . .

was recovered by this Torit Diamond Dust Collector . . .

at the rate of (50.5) carats in 14 days.

exclusive new centrifugal design simplifies recovery, serves all diamond grinding operations

Actually pays for itself in days. In an on-the-job test of this new TORIT equipment, the initial investment was returned in just 21 operating days. The test was conducted by a leading automobile manufacturer under regular operating conditions. Recovery averaged 30% of the carats originally contained in the diamond grinding wheels. You actually get a cash return of $1.00 for every $10.00 invested in diamond grinding wheels.

For all diamond grinding operations. This new TORIT Collector provides the same outstanding performance in all types of grinding operations—mist, wick or dry. Its design and operational simplicity also mean virtually maintenance-free service. Its tough construction assures long, long life.

Installs anywhere. TORIT'S new Diamond Dust Collector can be used alone or in conjunction with central exhaust systems or unit dust collectors. It weighs only 65 lbs. and requires only 14″ x 22″ floor space. Its centrifugal separating action uses no filters or sloppy, inflammable oil baths. Service is quickly and conveniently performed by simply unscrewing the unit's top for removal and emptying of the clear plastic container.

FREE details and full specifications on request. Here's your chance to really save on your diamond usage. Write today for full information on this important new diamond grinding development. Dept. 1310.

TORIT MANUFACTURING COMPANY Walnut & Exchange Sts., St. Paul, Minnesota

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-128

in. Measuring accuracy over the entire range is ±0.000010 in.

The gaging head is completely jeweled, has a sapphire tipped contact point to minimize wear, shockproof movement and an extra lift of the plunger to prevent damage to the instrument when measuring grooves.

Tolerances can be indicated on the outside of the dial window by hand movement of two tolerance markers. Zero adjustment of the indicating hand is by a knob located on the outside of the housing.

George Scherr Co., 200 Lafayette St., New York 12, N. Y. **T-8-26**

DeburringTool

The R & R deburring tool is designed to give a precision-cut edge or chamfer at high speed. Model 955 utilizes spring tension against the blade to effect cutting action; Model 956 uses spring tension against the body. Both are adjustable to regulate the depth of the cut. The blade is free-floating to allow

self-alignment and uniform stock removal. Because the tool is so designed that the workpiece is in continuous contact with the bearing angle of the tool with sufficient pressure to cause the blade to make a chip, there is no chatter. The blade extends outward the thickness of the chip only, so vibration is avoided.

Both models are available in a full range of sizes to 1½ in. diam.

Universal Engineering Co., Frankenmuth, Mich. **T-8-27**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Jig Borer

Designed for use where requirements include machining or inspecting large components with extreme precision, this jig borer is capable of locating accurately to 0.0001 in. and can accomodate workpieces as high as 70 in. It can bore to the center of a workpiece 80 in. in diameter. The machine, designated the 4EA jig borer, has an accurate vertical alignment over its entire 64-inch travel, because of the column construction with counterbalances supported by an independent superstructure and not by the column itself.

The machine can be equipped with P & W numerical control to provide automatic positioning of the rectangular worktable, and which can be arranged to control the indexing of a built-in 48-in. rotary table.

With numerical control, the table is usually positioned by data fed into the machine's control system by means of a

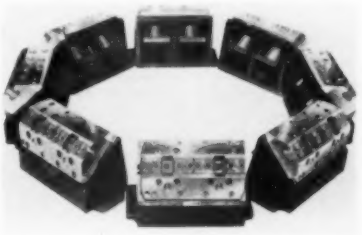
punched tape. Otherwise, the operator can position the table using one of the two control stations that allows the operator to dial the desired positioning data. First of these stations is located at the front of the bed and the second located on the spindlehead. All input data from the tape or dial system is always clearly shown on a display panel located on top of the machine's tape reader.

Pratt & Whitney Co., Inc., West Hartford 1, Conn. **T-8-28**

Holding Fixture

This dual-chucking, cylinder-operated holding fixture is designed to be used individually or mounted in groups on a rotating worktable and to provide simultaneous chucking of two identical parts. Clamping jaws are set at a 45 deg angle to permit both horizontal and vertical machining of the workpiece without rechucking.

In operation, each set of master jaws on the dual unit is operated by a double acting integrally mounted cylinder through a cam and lever mechanism. The fixtures, which are hydraulically

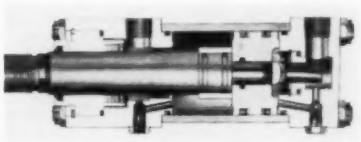


actuated, require 200 psi working pressure. Blank jaws supplied can be machined to suit workpiece configuration. Maximum jaw travel is 5/16 in. Built-in chip covers are furnished to keep jaw ways free of chips.

The S-P Mfg. Corp., 30201 Aurora Rd., Solon, Ohio. **T-8-29**

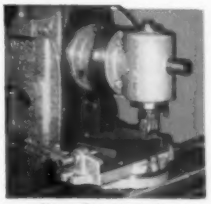
Fluid Power Cylinders

Lines of automation air and hydraulic cylinders, are designed to automotive industry "automation standards" to meet demands of high-speed automatic

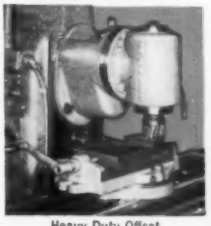


production. These versatile cylinders, which meet JIC standards, are fabricated to give maximum efficiency and long life with minimum maintenance.

They provide 200 psi for air operation

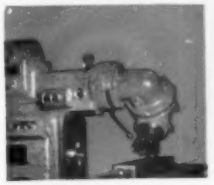


Heavy Duty Vertical Milling Attachment



Heavy Duty Offset Vertical Milling Attachment

Universal Milling Attachment



Toolmakers Overarm

Heavy duty attachments increase versatility of dependable, low-cost

GREAVES MILLS

"THE MOST MILL FOR THE LEAST MONEY"

A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS. Make your own comparison of 22 specifications of Greaves and 7 other leading milling machines.

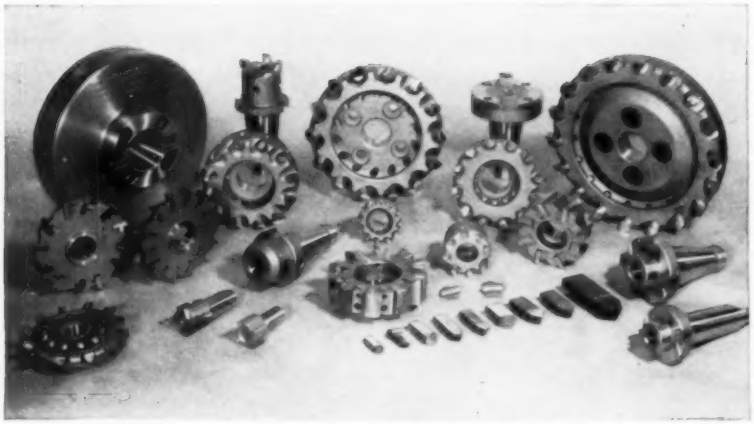
Send coupon for FREE Comparison Chart and detailed descriptive literature on easy-to-use attachments.

GREAVES MACHINE TOOL CO.
2303 Eastern Avenue, Cincinnati 2, Ohio

Send Comparison Chart. I will make my own comparison of GREAVES MILLS with other makes.
Send information on Attachments and Accessories for GREAVES MILLS.

NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-129



Milling Cutters — End Mills — Blades — Boring Tools — Arbors — Flywheels

These Lovejoy Products can help you Cut Costs!

The entire line of Lovejoy Milling Cutters and Accessories is designed to aid you in getting better production at less cost.

If you are not now using Lovejoy products, we invite you to do so at first opportunity.

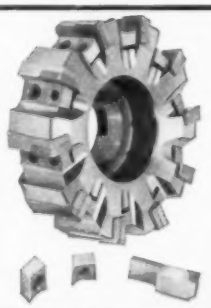
Lovejoy precision-engineered tools include:

Inserted-tooth milling cutters (face, side, end, slotting and boring) which feature husky, forged steel housings; exclusive Lovejoy "positive-locking" blade assembly; a variety of dozens of models and hundreds of sizes.

Blades: H.S.S., Vasco Supreme and carbide. These are interchangeable over a wide range of housing sizes, and Type "A" face milling blades will fit any standard Lovejoy Type "A" cutter of 4½" to 24" dia. All Lovejoy blades are carried in stock, ready for immediate shipment. Special cutters are a Lovejoy specialty.

NEW "JOYDEX"

This performance-proved face mill features indexable blades for low cost-per-edge cutting. Exclusive design improvements include — adjustable anvils • extra deep chip flutes • fast, easy indexing • sweep blades for fine finish • double positive, or combination positive and negative rake angles merely by changing blades • rugged, one-piece body • large locking screws. *Try out a new "Joydex" and prove its superiority! ("Joydex" data sheet is yours for the asking).*



Catalogs — include: "Face Mill Catalog No. 31; Side Mill Catalog No. 32; Type "S" Bulletin; Arbor Catalog No. 33; "Speed and Feed" Calculator. Write today for copies desired.

LOVEJOY TOOL COMPANY, INC.
Springfield, Vermont, U. S. A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-130

and 1000 psi for hydraulic operation.

Ortman-Miller Machine Co., Inc., 13 143rd St., Hammond, Ind. **T-8-30**

Boring Head

This precision boring head, made to order only, can finish bore a hole on the withdrawal stroke; it then can retract its tool bit to prevent marking of the finished hole as the head is withdrawn.

Retraction and feedout can be handled automatically without interrupting the machine cycle or stopping the machine spindle from rotating. Because of this retraction there are no tool drag lines on hole surface caused by bar

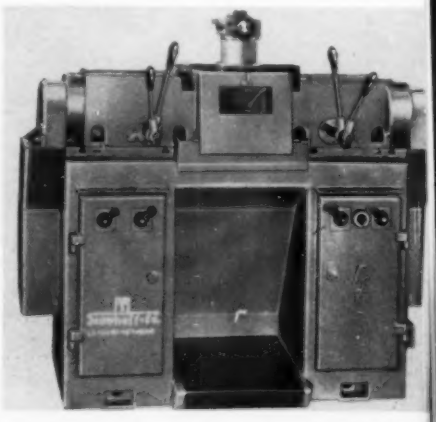
deflection when boring tools are withdrawn from the finished work. Thus, in some cases secondary finishing operations are unnecessary. The tool bit can be adjusted for wear without loosening or tightening any parts. Adjustments as fine as 0.0001 in. are made in a matter of seconds.

A plunger inside the machine spindle is used to control retraction and feedout. Any conventional actuating system can be used to power the plunger movement ½ in. in both directions. The plunger retracts the tool as it moves forward; withdrawing the plunger causes repositioning to a positive pin stop.

Briney Mfg. Co., 1165 Seba Rd., Pontiac, Mich. **T-8-31**

Borer-Threader

Small and medium size double-ended parts can be machined at production rates by this unit which provides for drilling, turning, fly cutting, facing,



threading and tapping, and similar operations, simultaneously on both ends of the work.

An air-operated clamp holds the stock piece in a center fixture, while two sets of opposed spindles perform the work. The forward set does the boring, turning and facing, while the second set of spindles handle threading, tapping and reaming. The workholder slides quickly from one position to the other. Power feeds engage and stop automatically at adjustable settings. Manual controls can be operated easily from a sitting position.

Distributed and serviced by Technical Development Co., 307 S. Chester Pike, Glenolden, Pa. **T-8-32**

Vise

This vise operates with a quick-action cam lever that opens or closes jaws immediately and uniformly. An eccentric handle then locks the workpiece in a

secure power grip. The precision-built vise is made in three sizes with extreme openings of 3¼, 4⅜₁₆, and 6⅞₁₆ in.

The Fenn Mfg. Co., Fenn Rd., Newington, Conn. **T-8-33**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Interchangeable Counterboring Tools

These heavy-duty counterbores are available with either high-speed steel or carbide tipped cutters. Spline-Taper drive assures permanent alignment and

allows complete interchangeability of pilots, cutters and holders.

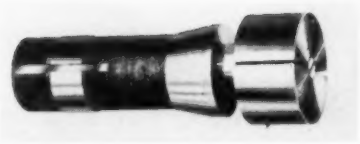
A wide range of counterboring and countersinking operations are possible with a minimum of tooling. Replacement of worn cutter members is simple.

National Twist Drill and Tool Co., Rochester, Mich. **T-8-34**

Internal Collet

The accurate Empire internal collet, constructed on a standard 5C collet body, is machinable on the machine. One basic unit will accommodate many pads which can be removed and replaced accurately. It also can be used in threading or tapping operations where collapsible taps or dieheads are employed.

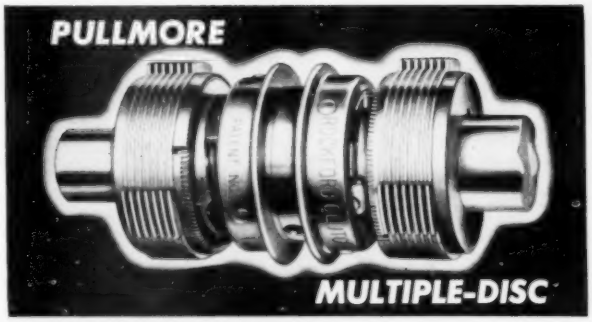
There is no need for arbors; the collet fits all standard 5C draw bars, fixtures, grinders, etc. Standard internal collet

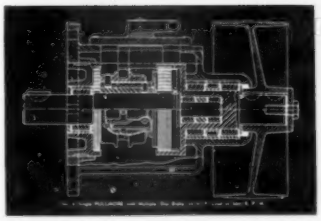


pad, 1¾ OD x 1 in. long, is machinable with a high-speed tool bit to ⅜-in diam. The collet "package" includes basic collet body, pad, retaining ring and wrench.

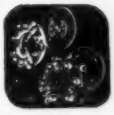
Royal Products, 78 Union St., Mineola, L. I., N. Y. **T-8-35**

ROCKFORD





CLUTCHES (Single or Double) PROVIDE HIGH-RATIO LEVER DESIGN


Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

COMPACT DESIGN
HIGH TORQUE
HIGH-RATIO LEVERS *
POSITIVE NEUTRAL
PRECISION BUILT
LONG WEAR LIFE
EASY ADJUSTMENT

*High-ratio operating levers give PULLMORE clutches powerful engagement with slight axial pressure and short movement of the shifter spool; consequently operation is quick and easy. Declutching is equally fast and positive. The shifter spool has an extra deep slot which is hardened and ground. This prolongs the life of the clutch, reduces wear on the shifter fork and holds run-out to a minimum.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD Clutch Division BORG-WARNER
1329 Eighteenth Ave., Rockford, Ill., U.S.A.
Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-131

A Brazing Story in Five Parts ...with Handy & Harman EASY-FLO

The Perlman Heat Treating Corp., Westbury, Long Island, brazes aircraft fuel system parts for WEBA, Inc. One of these is a fuel filter screen. It consists of five parts: two stiffeners, a screen and two end fittings, all of 302 stainless steel. All of these parts are joined by EASY-FLO silver brazing, using both induction and hand-torch heating methods.

A novel feature is the induction heating method used to braze the two stiffeners to the screen. It is sort of an "upside-down" method, through an asbestos board and carbon block, on which the screen rests with the EASY-FLO wire preform preplaced. The board and block permit enough passage of heat to melt the alloy to the mesh and stiffeners without excess overflow. Because the alloy won't wet the carbon block, the result is a clean, finished fillet.

The larger, cage-type fitting is HANDY-FLUXED, as is the circular preform of EASY-FLO, then assembled and placed in an induction coil. The smaller end fitting is inserted in the screen, preheated by induction and then torch-brazed, with the alloy being hand-fed. Alloy cost for the entire assembly is ten cents.

The main point here is the adaptability not only of the alloy, but the *brazing method.* Hardly anything stands in the way of brazing that a little ingenuity can't solve, as Perlman Heat Treating has demonstrated. We'll be very glad to bring the full and very beneficial brazing story to your attention. More and more, people with all kinds of metal-joining problems are finding that Handy & Harman silver alloy brazing has most of the answers. Answers that may benefit you.

FIRST, BULLETIN 20 – This informative booklet will get you off to a good start on the values, techniques and economies of low-temperature silver brazing. A copy awaits your request.

Your NO. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN QUALITY SERVICE

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES AND PLANTS
ATLANTA, GA.
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
LOS ANGELES, CALIF.
OAKLAND, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

FIELD notes

The Board of Regents has approved changes in name and functions of the Engineering Research Institute at the University of Michigan. New name will be University of Michigan Research Institute. Its functions, which have been concentrated largely in engineering and the physical sciences, were broadened to include all areas of university contract research programs.

V V V

All metals research, development and metallurgical activity are being combined in a new Technology Dept. at Crucible Steel Co. of America. According to company president, Joel Hunter, "The accelerating technical program at Crucible requires a realignment of our organization to better coordinate scientific progress with changing customer requirements and improved steelmaking practice." The department will be headed by Dr. M. J. Day, vice-president-technology, formerly vice-president, research and development.

expansions

The Landis Machine Co. has purchased Maiden & Co. Ltd. of Cheshire, England. Present facilities of the new concern, which will be known as Landis Machine-Maiden Ltd., will be doubled for manufacture of Landis chasers and distribution of Landis die heads.

V V V

A $75,000 expansion program is underway at Heli-Coil Corp. involving renovation of administration, research and engineering offices.

V V V

Plant expansion for the Bendix Filter Div. of Bendix Aviation Corp. will provide 14 percent increase in floor space for manufacturing. The expansion is taking place at the company's main plant in Madison Heights, Mich.

V V V

Magnetics, Inc. marked completion of a plant expansion and improvement program with start of operations in June. The addition provides enlarged production space for static devices and houses an enlarged and modernized area for production of cores, an enclosed shipping-receiving dock, raw material storage area and a stock room.

V V V

An addition to the main building of Pioneer Engineering & Mfg. Co. on John R St. in Detroit has been completed to provide a 25 percent addition in floor area. Initially, the extra space will permit expansion and reorganization of centralized files of engineering-reference and client data.

new facilities

Construction of two 57,500-sq ft buildings for its Systems and Transducer Divs. is being completed for Consolidated Electrodynamics Corp. in Monrovia, Calif. Both divisions formerly operated in Pasadena. The $1½-million development provides office, laboratory and plant buildings with removable metal walls at one end to allow for future expansion.

V V V

Dedication of its $250,000 foundry and Southwest sales center officially opened Ampco Metal's new facilities in Garland, Texas. The new plant is located at 630 S. Jupiter Rd.

V V V

A facility to combine western activities of Pesco Products Div. of Borg-Warner Corp. is under construction at 3310 Vanowen St., Burbank, Calif. Including equipment and leasing costs, it represents a total investment of more than $1-million.

V V V

Under construction for Allied Pacific Mfg. Co. is a 30,000-sq ft plant at 17825 S. Santa Fe Ave. in the Rancho San Pedro industrial area of Long Beach, Calif. Investment in land, building and equipment in the new plant is expected to be in excess of $600,000.

V V V

A manufacturing plant and office facilities is under construction for Tomkins-Johnson Co. The new headquarters, located adjacent to Jackson, Mich., will comprise 111,280 sq ft and will approximately triple office and plant space at the current location. Completion date is set for this Fall and occupation and operation is expected by late 1958 or early 1959.

V V V

A total of $51-million has been tabbed by The Timken Roller Bearing Co. for expenditure during the next five years on new equipment and facilities. More than $3-million worth of new grinding and finishing equipment already has been ordered for installation in Canton, Columbus and Bucyrus plants, and an additional $2½-million will be spent, thus increasing grinding and finishing productivity by an expected 30 percent.

trade associations

National Screw Machine Products Assn. is publishing a series of technical bulletins, first of which is "How To Get Better Critical Parts at Cost-Saving Prices." Known as Fact File No. 1, it details design, production and application data on screw machine blanks engineered to provide close tolerances in manufacture of critical hydraulic pump pistons. The bulletin is available from the association, 2860 E. 130th St., Cleveland 20, Ohio.

V V V

Investment Casting Institute has completed two new investment casting metal specifications. The FE-3 specification covers cast nickel-chromium stainless steel while the CU-2 deals with specifications for beryllium copper.

V V V

Rhode Island Tool and Die Manufacturers Assn. is sponsoring a series of meetings on the theme of "Come See What's *Right* with Rhode Island Industry." First plant to host the series was Abrasive Machine Tool Co. Initiative for the program grew from the society's belief that the "recession" is caused by state of mind and that industry needed an opportunity to see for itself what progressive steps firms in the state are taking to boost sales, swell employment and gain bigger market shares.

V V V

Metal Powder Industries Federation, formerly identified as the Metal Powder Assn., has started publication of a new technical periodical called the *Powder Metallurgy Quarterly*. First issue of the magazine, dated Spring, 1958, is devoted almost entirely to applications and characteristics of wide variety of gears that can be made by powder metallurgy methods. Future is-

sues are expected to be expanded in length and will be devoted to other fields of application. Copies are available from the federation, 130 W. 42nd St., New York 36, N.Y.

v v v

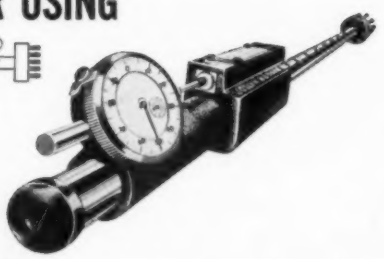
Gray Iron Founders' Society held four regional management meetings for representatives from more than 150 foundries. J. Scott Parrish, Jr., society president, and headquarters' staff executives were feature speakers at the sessions held in Monterey, Calif., Waukegan, Ill., Ft. Wayne, Ind., and Pottstown, Pa.

new activities

Flexonics Corp. has formed an Expansion Joint Div. This is the second of five operating divisions being established under a new organizational plan. Headquarters of the division will be located at the company's Savanna, Ill., plant.

ACRA STOP®
A MICROMETRIC TRAVEL CONTROL
PRECISION INSTRUMENT FOR
REPEAT MACHINING
the HOW with
ACRA STOP®
Accurate cutting to within one thousandth of an inch. This device makes it possible to set up an engine lathe with up to 104 precision stops in a 15" run.

6 GOOD REASONS FOR USING
ACRA STOP®



- SET-UP TIME CUT IN HALF
- PRODUCTION DOUBLED
- FIRST CLASS MACHINING PRODUCED BY SEMI-SKILLED LABOR
- COSTLY REJECTS ELIMINATED
- INSPECTION TIME AND INTERVALS REDUCED
- PRECISION MADE AND FULLY GUARANTEED

complete with mounting accessories
f.o.b. Santa Monica, Calif.

WRITE TODAY FOR COMPLETE INFORMATION
SOLD ONLY THROUGH
LEADING DISTRIBUTORS EVERYWHERE

JOSLYN-HUDSON CORPORATION
2040 Colorado Avenue · Santa Monica, California

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-134

Unistrut Products Co. has established two company-owned subsidiaries, one in California and one in Georgia. The California unit is Unistrut Northern California, in Berkeley, formerly operated as an independently owned distributorship. Its operation is to be expanded to service distributors in Western United States and Canada through sales, engineering and warehousing facilities. The second subsidiary is Unistrut Steel Service Co. in Atlanta servicing the territory formerly served by an independently owned distributorship. This company will be expanded to serve the southeast.

v v v

To expand its service facilities in the area, Vickers-Sperry of Canada Ltd. has opened a new office for sales, service and repair of Vickers oil hydraulic components at 150 W. First Ave., Vancouver, B.C.

anniversaries

Sixtieth anniversary of its founding is being celebrated by American Nickeloid Co., a pioneer manufacturer of prefinished metals. The company is marking the event with introduction of several new products for its field.

v v v

Half a century of growth is being celebrated by U. S. Electrical Motors Inc. which has grown from a small ground-floor location in Los Angeles to a nationwide and international manufacturing and sales organization. Today the company has six major plants and facilities—five in the United States and one in Mexico.

moves

Central office of Borg-Warner Corp. has moved to the new Borg-Warner Bldg. at 200 S. Michigan Ave. in Chicago. At present the company has taken over the top three floors of the new building; later it will also occupy additional rooftop quarters which are not yet completed.

v v v

The Los Angeles branch office of Whitman & Barnes has been moved to new, larger quarters at 5226 E. Washington Blvd. As a sales office and branch warehouse, it provides 5400 sq ft of space to permit more adequate stocking area.

v v v

Administrative, sales and service sections of Louis Allis Co. for the southern California area are brought under one roof with the move into the newly completed district office and warehouse

building at 4405 E. Olympic Blvd. in Los Angeles. The new facility will stock a complete line of standard and special motors.

V V V

With the opening of new facilities on Walsingham Rd., Largo, Fla., Arrow Engineering Co., Inc. has moved from the Midwest to South.

new company

Skyvalve, Inc. has been formed as a subsidiary of Engelberg, Inc. to specialize in engineering, development and manufacture of high pressure pneumatic and hydraulic valves for aircraft missiles and rockets. John T. Schenck, president of Engelberg was also named president of the new company while Robert L. Schaller became its vice-president and general manager.

acquisitions

Joint announcement by National Steel Corp. and Crown Cork and Seal Co., Inc. was made of completion of plans for purchase by National's Weirton Steel Div. of Crown's cold reducing mill and supplementary equipment for manufacture of electrolytic tin plate. According to present plan, the equipment, which is located at Crown's Baltimore plant, will be utilized in Weirton Steel Div. operations.

V V V

Industrial Filtration Co. has been acquired by Commercial Filters Corp., a subsidiary of Ogden Corp. and will be operated as a part of Indiana Commercial Filters Corp. with headquarters in Lebanon, Ind.

V V V

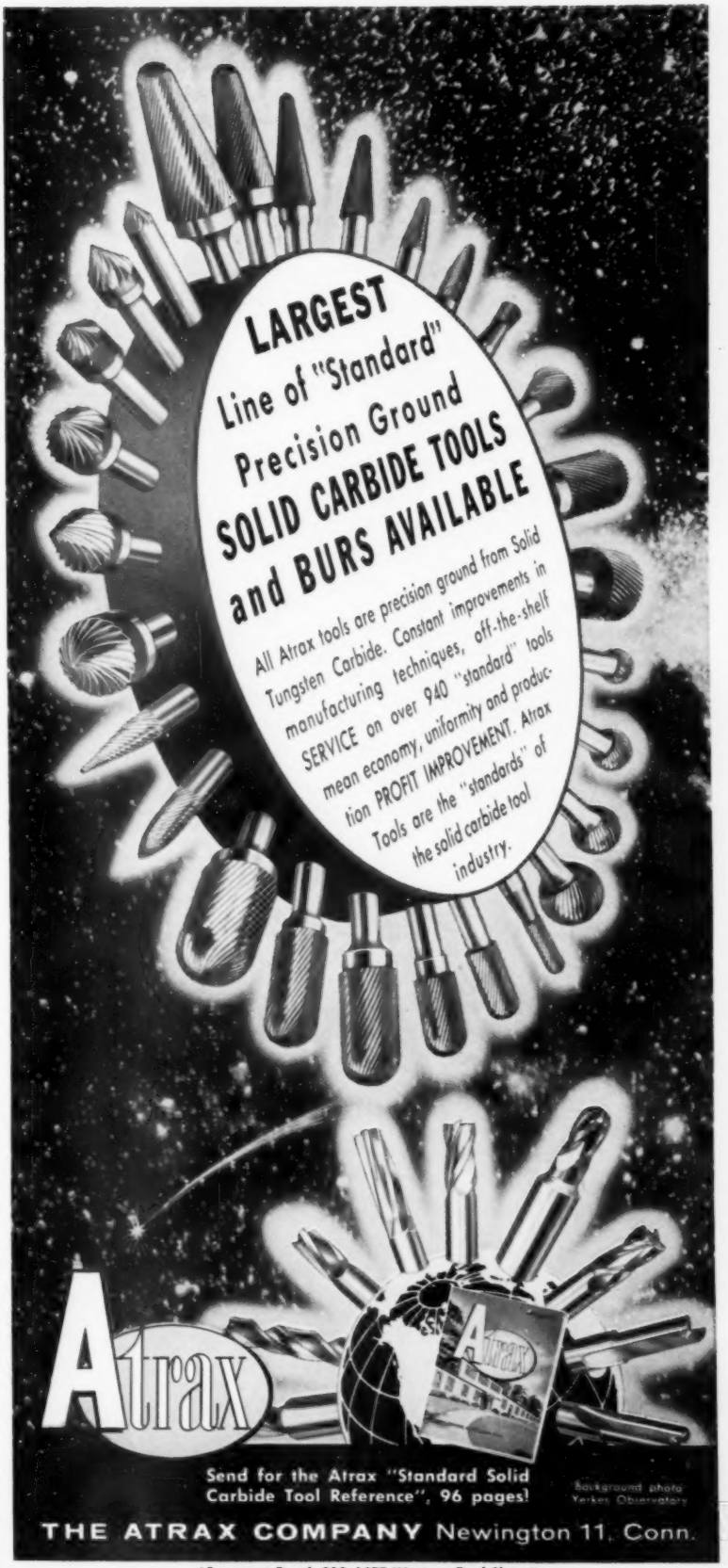
The line of Diebel Hi-Production automatic presses has been acquired from the Di Machine Corp. by Havir Mfg. Co. The transaction includes the complete line of metal stamping presses plus tools, designs, patents and inventories. Manufacture of the presses will be in St. Paul and all castings will be made at the company's foundry there.

V V V

Controls Co. of America has acquired Redmond Co., Inc. through purchase of inventories, tooling, patents and trademarks for approximately $1,715,000.

V V V

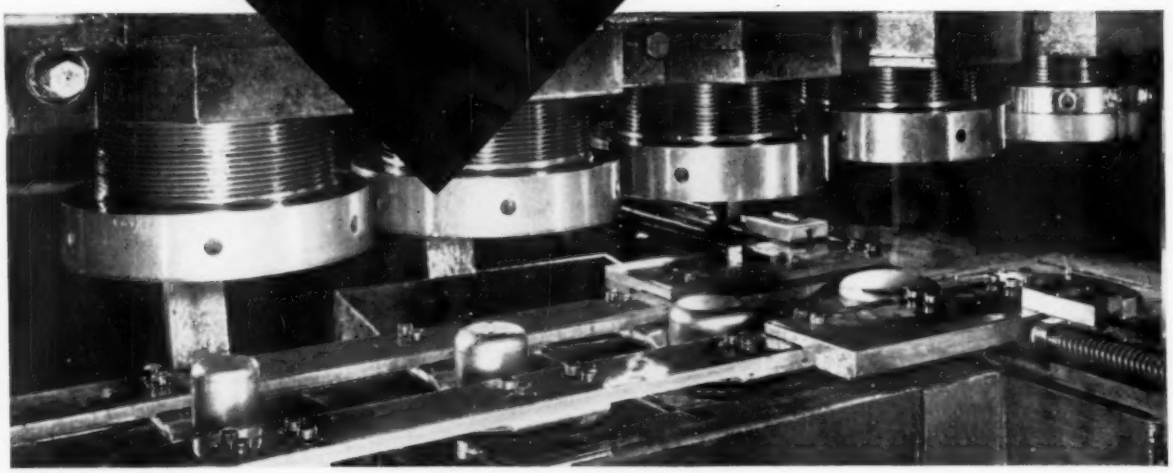
Acquisition of Airborne Instruments Laboratory Inc. by Cutler-Hammer Inc. has been agreed to by stockholders of both companies. In the future, AIL will operate as the Electronics Div. of Cutler-Hammer, retaining its name, officers, management, personnel and line of business.


LARGEST
Line of "Standard"
Precision Ground
SOLID CARBIDE TOOLS
and BURS AVAILABLE
All Atrax tools are precision ground from Solid Tungsten Carbide. Constant improvements in manufacturing techniques, off-the-shelf SERVICE on over 940 "standard" tools mean economy, uniformity and production PROFIT IMPROVEMENT. Atrax Tools are the "standards" of the solid carbide tool industry.
Atrax
Send for the Atrax "Standard Solid Carbide Tool Reference", 96 pages!
Background photo Yerkes Observatory
THE ATRAX COMPANY Newington 11, Conn.

See us at Booth 820 ASTE Western Tool Show
Los Angeles, September 29—October 3
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-135

MEL-TROL

at work



To deliver uniform performance between grinds, a drawing or blanking die has to be hard and tough through its whole thickness.

And no matter how well it is designed and heat treated, it can only be as uniform through the center as the bar you make it from . . . and the bar can only be as uniform as the ingot from which it is rolled.

That's why, when you make a die from Carpenter MEL-TROL air hardening die steels—such as No. 484 and No. 610 —you *know* you're going to get predictable performance. The high quality of MEL-TROL die steels is guarded by a system of the most advanced and accurate quality controls ever used in steel making.

And an exclusive Carpenter-patented mold produces ingots with greater uniformity through the center than any others made on a production basis today.

Why don't you try Carpenter MEL-TROL quality tool and die steels? Call your Carpenter representative and place your order today.

Carpenter STEEL

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.
Webb Wire Division, New Brunswick, N. J.

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-S-199—Hydrive—*Acme Industrial Co.* Literature available lists many advantages of Hydrive operated turret lathe. (Page 199)

A-S-10—Shear Blades—*Allegheny Ludlum* booklet describes handling and shock treatment of A-L 609 shear blade steel. (Page 10)

A-S-8—Lathes—*American Tool Works Co.* Bulletin No. 144 describes features of American double carriage pacemaker lathe. (Page 8)

A-S-143—Broaches—*Apex Broach Co., Inc.* Holders and fixtures described in Apex brochure. (Page 143)

A-S-144—Hack Saw Blades—*Armstrong-Blum Mfg. Co.* New bulletin on Marvel cutting tools available. (Page 144)

A-S-135—Carbide Tools—*The Atrax Co.* New 96-page book "Standard Solid Carbide Tool Reference" now available. (Page 135)

A-S-202-1—Vibratory Feeders—*Automation Devices, Inc.* New literature on the latest Peeco feeding technique available on request. (Page 202)

A-S-37—Optical Gage—*Bausch & Lomb Optical Co.* Catalog D-285 describes B&L DR-25 optical gage. (Pages 36-37)

A-S-161—Air Motors—*Bellows Co.* Bulletins BM-25 and HC-602 give full details on Bellows air motors and hydrochecks. (Page 161)

A-S-182-3—Drills—*Black Drill Co.*—"Hardsteel" Operators Manual shows how "Hardsteel" drills are cutting costs. (Page 182)

A-S-205-1 — Fixture Components — *Carr-Lane Mfg. Co.* Catalog No. 5 describes many types of jigs and fixture parts. (Page 205)

A-S-172-3—Protective Covers for Guide Pins—*Central Safety Equipment Co.* Complete data on elasticone protective coverings which close shafts included in new bulletin '57 and Data Sheet '58. (Page 172)

A-S-188-3—Alloys—*Cerro de Pasco Corp.* 63 Cerro Alloy applications described in new Booklet No. 14, "How To" (Page 188)

A-S-155—Rivets—*Chicago Rivet & Machine Co.* Rivet catalog describes 1388 standard tubular and split rivets, 26 automatic rivet setters. (Page 155)

A-S-11—Milling Machine—*The Cincinnati Milling Machine Co.* Catalog M-1913-2 describes the Cincinnati Powermatic Rise and Fall. (Page 11)

A-S-123—Center Drilling—*Circular Tool Co.* Catalog "O" available listing wide range of center drills. (Page 123)

A-S-BC—Presses—*Clearing Machine Corp.* Features of Clearing Torc-Pac presses are described in new brochure. (Back Cover)

A-S-13—Boring Tools—*DeVlieg Microbore Div., DeVlieg Machine Co.* Catalog No. 6 describes Microbore precision boring tools and applications. (Page 13)

A-S-177—Contour Machines—*DoALL Machine Co.* Two new DoALL Models, No. 16M and 30M, described in Bulletin 58-34. (Page 177)

A-S-126-2—Insert Chasers—*Eastern Machine Screw Corp.* "Unified and American Screw Thread Digest" available on request. (Page 126)

A-S-142—Abrasive Belt Grinders—*Engelberg, Inc.* Free catalog sheet contains complete information and specifications on Engelberg Series 96 abrasive belt machines. (Page 142)

A-S-188-1—Casting Compound—*Fiske Bros. Refining Co.* Bulletins describing Fiske's Die Casting Compound and other specialty lubricants and coolants available. (Page 188)

A-S-22—Grinding Machines—*The Foote-Burt Co.* Circular No. 13A gives complete information on the Hammond No. 2 surface grinders. (Page 22)

A-S-140—Microscopes—*The Gaertner Scientific Corp.* Bulletin No. 147-56 shows applications, models and specifications of various microscopes. (Page 140)

A-S-146—Air Cylinders—*Nopak Div., Galland Henning.* Complete line of Nopak air cylinders described in Catalog 101A. (Page 146)

A-S-132—Silver Brazing—*Handy & Harman* Bulletin No. 20 gives information on design methods and economies of silver alloy brazing. (Page 132)

A-S-167—Cylinders—*Hanna Engineering Works.* New-design hydraulic cylinders described in Catalog 900. (Page 167)

USE THIS HANDY FORM ➡

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

858 ***THE TOOL ENGINEER DETROIT 38, MICH.***

READER SERVICE CARD

Please send me further information as indicated below:

(Mark Key Number of trade literature, tools or advertisements)

ADVERTISERS	TRADE LITERATURE	TOOLS OF TODAY
A—	L—	T—
A—	L—	T—
A—	L—	T—
A—	L—	T—

NAME _____ POSITION _____

FIRM _____ BUSINESS _____

Please Check One ☐ Firm Address ☐ Home Address } STREET _____

CITY _____ ZONE NO. _____ STATE _____

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-S-115—Progressive Dies—*The B. Jahn Mfg. Co.* Brochure contains 20 pages of case histories using Jahn dies. (Page 115)

A-S-165—Milling Machines—*Kearney & Trecker Corp.* New K&T "Mil" production milling machine described in free Bulletin MM-58. (Pages 164-165)

A-S-125—Induction Heating—*Lepel High Frequency Laboratories, Inc.* Information available on the power units in 36-page catalog. (Page 125)

A-S-175—Hydraulic Valves—*Logansport Machine Co., Inc.* Hydraulic valve design made each year with free calculator. (Page 175)

A-S-162-3—Toolholders—*Marcellus Mfg. Co.* Complete sizes and specifications for easier tool planning available in new catalog. (Page 162)

A-S-178-3—Milling Cutters—*W. F. Meyers Co., Inc.* Bulletin No. 52 describes the facilities of W. F. Meyers Co. for custom production of cutters. (Page 178)

A-S-141—Profile Recorder—*Micrometrical Mfg. Co.* "Proficorder" details described in free Bulletin LT-24. (Page 141)

A-S-170-3—Hydraulic Cylinders—*Modernair Corp.* Data bulletin describes Veritrol hydraulic checking cylinders. (Page 170)

A-S-21—Circular Saws—*Motch and Merryweather, Cutting Tool Mfg. Div.* New circular sawing handbook guide for sawing operations. (Page 21)

A-S-184—Thread Rolling Heads—*The National Acme Co.* Cost-reducing ideas with Acme-Fette self-opening thread rolling heads described in Bulletin NAF-57A. (Page 184)

A-S-38—Induction Heating—*The Ohio Crankshaft Co.* Free booklet "Typical Results of Tocco Induction Hardening and Heat Treating" available. (Page 38)

A-S-114—Hydraulic Cylinders—*Ortman-Miller Machine Co.* New bulletin No. 105 gives detailed information on heavy-duty hydraulic cylinders. (Page 114)

A-S-197—Aluminum—*Pioneer Aluminum Inc.* Applications of Pioneer 921-T cast aluminum tooling plate described in case history bulletin. (Page 197)

A-S-174—Turning Tools—*R and L Tools.* New catalog describes complete line of cutting tools. (Page 174)

A-S-124—Sine Plates—*Omer E. Robbins Co.* Catalog shows complete line of Robbins sine plates. (Page 124)

A-S-131—Clutches—*Rockford Clutch Div., Borg-Warner.* Typical installation shows Rockford clutches and power take-offs with diagrams. (Page 131)

A-S-188-2—Self-Aligning Bearing—*Southwest Products Co.* Revised engineering manual describes complete line of "Monoball" self-aligning bearings. (Page 188)

A-S-20—Cap Screws—*Standard Pressed Steel Co., Unbrako Socket Screw Div.* The full meaning of reliability discussed in new SPS booklet "High Reliability." (Page 20)

A-S-19—Surface Grinder—*The Thompson Grinder Co.* Catalog T558 describes Thompson's Truforming grinders. (Page 19)

A-S-178-2—Balancing Machines—*Tinius Olsen Testing Machine Co.* Bulletin 56 describes Rava electro-dynamic balancing machines. (Page 178)

A-S-120—Riveting Machines—*Tomkins-Johnson Co.* Riveting and clinching described in Rivitor bulletins 646 and 555 and Clinchor bulletin 555. (Page 120)

A-S-173—Multi-Slide Machines—*U. S. Tool Co., Inc.* Copies of multi-slide bulletin No. 15 (T) available. (Page 173)

A-S-23—Die Steel—*Vanadium-Alloys Steel Co.* Detailed data sheets describe steels for plastic molds and die-casting dies. (Page 23)

A-S-112—Carbide Tools—*Vascoloy-Ramet Corp.* Bulletin 5803 contains complete information on all V-R standard carbide grades. (Page 112)

A-S-172-1—Abrasive Cut Machine—*Wallace Supplies Mfg. Co.* Free 44-page book on Wallace cutting machines. (Page 172)

A-S-196-1—Adjustable Dies—*S. B. Whistler & Sons, Inc.* Complete details on Whistler adjustable perforating dies in new catalog. (Page 196)

A-S-194—Hardness Testers—*Wilson Mechanical Instrument Div. of American Chain & Cable.* New bulletins give complete information about Wilson Rockwell hardness testers. (Page 194)

A-S-152—Slitter Mills—*The Yoder Co.* Fully illustrated 1958 edition of Yoder's Slitter Book describes advantages of operating Yoder slitters. (Page 152)

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

FIRST CLASS
PERMIT NO. 10782
(Sec. 34.9, P.L. & R.)
DETROIT, MICH.

THE TOOL ENGINEER
ASTE Building
10700 Puritan Ave.
Detroit 38, Mich.

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

MEN at WORK

J. Hubert Cuni has become vice-president of The Lodge & Shipley Co. in addition to his work as director of industrial relations, a post he has held for the past nine years.

The newly created post of branch operations manager of the Machinery Hydraulics Div. of Vickers Inc. is now held by **G. M. McKeown.** He previously was manager of customer services.

George A. Lagassa (left) is new vice-president-manufacturing of Titeflex, Inc. He previously was associated with Elbeeco Div. of Aeroquip Corp.

William H. Muchnic (right), president of The LFM Mfg. Co., Inc., a subsidiary of Rockwell Mfg. Co., was elected a vice-president of the parent firm.

New officers elected at the annual meeting of the Industrial Diamond Association of America, Inc., include **Morris Winston** as president, **Donald J. Wallace** as first vice-president and **Bernard Jolis** as second vice-president. Mr. Winston is associated with Diamond Drill Carbon Co. Mr. Wallace, a member of ASTE's Detroit chapter, is associated with Wheel Trueing Tool Co. Mr. Jolis works with U. S. Industrial Diamond Corp.

In an expansion of responsibility of its divisional executive officers, Pratt & Whitney Co. Inc. named **Albert L. Knapp** and **Edward J. Shages** to head the sales activities of their respective operations. Mr. Knapp is vice-president and manager of the company's machinery division, and Mr. Shages is vice-president and manager of its cutting tool and gage divisions. Both men are members of ASTE's Hartford chapter.

At the annual meeting of the American Electroplaters' Society, **Herberth E. Head** was elected national president to succeed Francis T. Eddy. Mr. Head, who previously served as first vice-president, is an engineer at Chrysler Corp.

Robert C. Baumgartner, former general sales manager of The Oster Mfg. Co., has been appointed vice-president of the company.

At the same time, **Clare R. Metcalf** assumed the post of sales manager in addition to his previous duties of company secretary.

Among officers elected for Surface Combustion Corp. are **James P. Farrell,** who now is vice-chairman of the board, and **Robin A. Bell,** who assumes the posts of executive vice-president of the corporation and president of Janitrol Div.

James A. D. Geier was elected to vice-presidency of Cincinnati Lathe and Tool Co. and at the same time was appointed assistant general manager of the company. Prior to these recognitions, he was assistant to the sales manager.

Harold H. Gillespie is new general manager of the Split Ballbearing Div. of Miniature Precision Bearings, Inc. He was vice-president and assistant general manager of the Barden Corp.

Election at Crucible Steel Co. of America made **L. L. Ferrall** executive vice-president and filled his former post of vice-president-operations with **J. D. Dickerson.** Mr. Dickerson previously was manager of steel production.

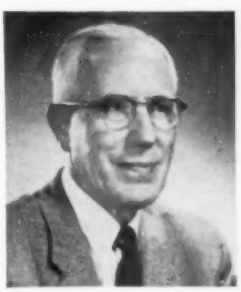
Edward C. Kinnaman is now production manager of Alloy Precision Castings Co. He previously was quality control manager.

At the same time, the company announced appointment of **David Brown** to the post of chief inspector. He formerly was with Republic Aviation Corp.

Five executives promoted by Gardner-Denver Co. included **Robert Williams** who became general plant adviser. He was succeeded in his former post of works manager by **A. J. Kathmann,** who was assistant works manager. **G. A. Schumacher** who was superintendent of the LaGrange, Mo., foundry, became manager of foundry operations, while **E. J. Brown** was promoted from assistant superintendent of LaGrange foundry to superintendent. **James A. Van Doorn** was placed in charge of Gardner-Denver's maintenance divisions in addition to duties as manager of facilities.

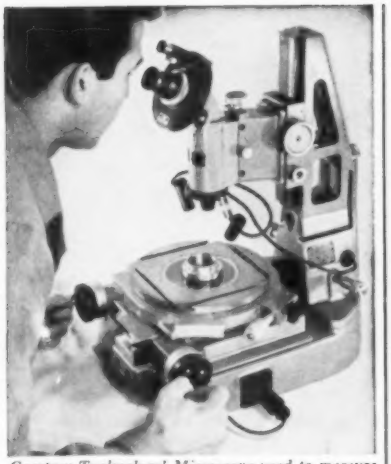
Cincinnati Milling Machine Co. recently announced election of **E. D. Vancil** as vice-president of the company and of **L. E. Eberts** as vice-president of the sales subsidiary, Cincinnati Milling and Grinding Machines, Inc. Mr. Vancil was previously manager of the Meta-Dynamics Div., while Mr. Eberts was assistant export manager of the parent company. The latter also is a member of ASTE's Hartford chapter.

Henry Wohlers was named to the newly created post of staff engineer for the machine and tools division of Michigan Tool Co. where he will head the field engineering service.



Henry M. Heyn (left), who was vice-president and general manager of the Industrial Div. of Surface Combustion Corp., is new president of both company and division.

N. M. Forsythe (right) was elected president of National Automatic Tool Co. He has been vice-president and general manager since 1954.



Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

Designed and manufactured by

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

INDICATE A-8-140

good READING

MATERIALS HANDLING HANDBOOK—*Edited by Harold A. Bolz and George E. Hagemann. Sponsored by The American Society of Mechanical Engineers and the American Material Handling Society. Published by The Roland Press Co., 15 E. 26th St., New York 10, N. Y. Price $20. 1750 pages.*

A comprehensive study of the various phases of materials handling technique organized for reference. It shows how to make a systematic analysis of all phases of materials handling from the incoming raw materials to final shipment of the completed product.

Data in this handbook includes both engineering information for designing a new materials handling system and management information for setup and control of various programs. These programs cover the education of personnel, industrial engineering phases and materials handling research.

Sections include pallets, containers, factory planning, terminal handling, conveyors, as well as cranes, lift trucks and commercial carriers.

AIDS TO EFFICIENT MACHINE DESIGN IN WELDED STEEL—*Published by The Lincoln Electric Co., Cleveland 17, Ohio. Price $1, postage prepaid. 94 pages.*

Contents of this book are based on a need found in Machine Design Seminars conducted at The Lincoln Electric Co. plant. Applications of the basic design principles are extended to simplified practices to aid the designer converting to sheet metal fabrications. The theme in many chapters of the book is redesign for lower costs.

The chapters include methods for redesign of cast bases, cast flywheels and the appraisal of steel designs for the lowest costs. Other steel design data supplies information on bases and flywheels under the effects of load, vibrations, bending, resisting torsion and fillet welds.

TOOLING FOR THE SPACE AGE!

ASTE WESTERN TOOL SHOW

AND CONFERENCE

SHRINE EXPOSITION HALL

LOS ANGELES, SEPT. 29-OCT. 3

For more information, write:
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVE.
DETROIT 38, MICH.

AMERICAN SOCIETY
TOOL SHOW CONFERENCE '58 SEPT 29 - OCT 3
OF TOOL ENGINEERS

who's meeting and where

Aug. 11-16. CASE INSTITUTE OF TECHNOLOGY. Short course on Numerical Machine Tool Control for engineers in the machine tool and allied industries.

Aug. 18-20. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Second national heat transfer conference, Edgewater Beach Hotel, Chicago, Ill. Get details from AICE office, 25 W. 45 St., New York 36, N.Y.

Sept. 2-6. UNIVERSITY OF KANSAS. Third annual Midwest work course on "Plant Layout and Facilities Planning." University Extension Center, Kansas City, Mo. Address inquiries to Midwest Work Course on Plant Layout & Facilities Planning, 4112 Eaton St., Kansas City 3, Mo.

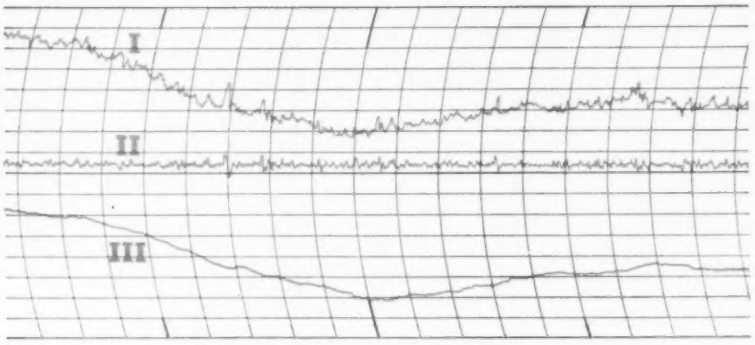
Sept. 2-12. MASSACHUSETTS INSTITUTE OF TECHNOLOGY. Special summer program in design and dynamics of mechanisms. For more data, write to Dr. Thomas P. Goodman, Asst. Prof. of Mechanical Engineering, M.I.T., Cambridge 39, Mass.

Sept. 8-19. WASHINGTON UNIVERSITY, Dept. of Industrial Engineering and University College. Ten intensive courses in industrial engineering including courses on engineering economy, materials and processes of manufacturing, tool engineering, plant layout and material handling, quality control, etc. Offered with cooperation of American Institute of Industrial Engineers, American Materials Handling Society, American Society of Mechanical Engineers, American Society of Quality Control, American Society of Tool Engineers, Association for Computing Machinery, Society for Advancement of Management. Deadline for application is Aug. 15. Obtain full information from Industrial Engineering Intensive Courses, University College, Washington University, St. Louis 5, Mo.

Sept. 12. SOCIETY OF PLASTICS ENGINEERS, INC., Detroit Section. Regional technical conference on "Plastics in Automotive Application", St. Clair Inn, St. Clair, Mich. Direct inquiries to so-

PROFICORDER®

MAKES MOUNTAINS FROM MILLIONTHS

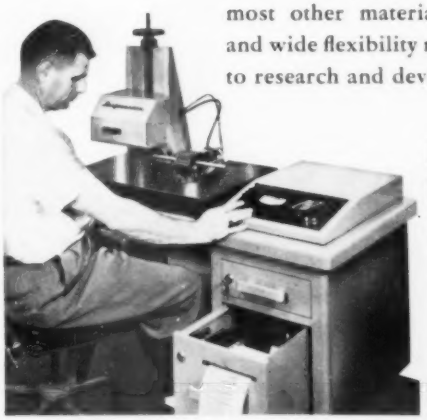


Three Proficorder records of same portion of a surface, reproduced ½ size, showing (I) total profile, (II) roughness profile, and (III) waviness profile. Note range of detail.

THE PROFICORDER draws a magnified profile of machined and finished surfaces, showing the *height, width* and *relative position* of the surface irregularities. It clearly shows any desired detail from over-all contour to fine roughness. Accordingly —

These charts permit detailed study and comparison of waviness . . . roughness . . . porosity . . . flaws . . . wear . . . and the effects of finishing processes.

The Proficorder will show (I) the total profile, (II) roughness alone, or (III) waviness, steps and other widely-spaced irregularities with roughness omitted. It is used on metals, paper, plastics, ceramics, and most other materials. Ease of operation and wide flexibility make it especially suited to research and development work.



FREE BULLETIN LT24

gives details. Write for it! And let us furnish you with profile charts of surfaces in which you are interested.

Proficorder is a registered trade-mark.

Made by the Profilometer® people —

MMC®

MICROMETRICAL MANUFACTURING CO.

349 S. MAIN ST. ANN ARBOR, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-141

Built to machine tool standards . . .
TO GIVE TOOL ROOM PRECISION . . .
IN PRODUCTION QUANTITIES!

NEW
ENGELBERG
SERIES 96
ABRASIVE BELT
MACHINES

AVAILABLE WITH FROM ONE TO SIX OR MORE GRINDING HEADS

CAPACITIES:

6" x 96" Belt:
5½" max. width and
6½" max. thickness

9" x 96" Belt:
8½" max. width and
6½" max. thickness

12" x 96" Belt:
11½" max. width and
6½" max. thickness

OPTIONAL FEATURES:

Electro-Magnetic chucks
Powered elevation of grinding heads
Built-in coolant filtration system

From the leaders in the industry . . .

The new Series 96 Heavy Duty abrasive belt machines are built to deliver toolroom precision in continuous production runs.

High speed multiple grinding and finishing operations are performed in the same time required for a single operation. Rapid, exceptionally heavy stock removal permits unmachined surfaces to be ground to fine finishes and exacting tolerances in one continuous pass.

Heavier construction and solid, one-piece work table enable Series 96 machines to maintain tolerance standards of ± .0005 on flat finishing, with stock removal up to 1/32" per head on ferrous material.

Conveyorized feed is adjustable, ranging from 0' to 67' per minute. Both conveyor and abrasive belts feature pneumatic tensioning.

Rapid-traverse grinding heads are equipped with #50-taper hardened precision ground spindles, with super-precision taper roller bearings.

Representing the peak of development in abrasive belt machines, Series 96 take their place beside the finest of machine tools for speed, precision, reliability and cost reduction.

Write today for free catalog sheet containing complete information and specifications on the Engelberg Series 96 abrasive belt machines.

ENGELBERG, INC.

Precision ABRASIVE BELT GRINDERS

308 SENECA STREET • SYRACUSE, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-142

ciety office, 34 E. Putnam Ave., Greenwich, Conn.

Sept. 14-19. Instrument Society of America. Instrument-Automation conference and exhibit. Convention Hall, Philadelphia, Pa. Further information is available from society office, conference and exhibit manager, Fred J. Tabery, 3443 S. Hill St., Los Angeles, Calif.

Sept. 15-17. American Society of Mechanical Engineers. Process industries conference, Statler Hotel, Buffalo, N.Y. For details, contact John D. Young, 16915 Buckingham Rd., Birmingham, Mich. or Richard C. Oglesby, c/o Rohm & Haas, 20211 Greenfield Rd., Detroit 35, Mich.

Sept. 22-23. Steel Founders' Society of America. Fall meeting, The Homestead, Hot Springs, Va. Get more facts from society office, 606 Terminal Tower, Cleveland 13, Ohio.

Sept. 22-24. Standards Engineers Society. Seventh annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa. Obtain details from society office, P.O. Box 281, Camden 1, N.J.

Sept. 23-26. Association of Iron and Steel Engineers. Iron and Steel Exposition, Cleveland. Complete data may be had from association office, 1010 Empire Bldg., Pittsburgh 22, Pa.

Sept. 25-27. Porcelain Enamel Institute. Annual meeting, The Greenbrier, White Sulphur Springs, W. Va. Contact institute office, Associations Bldg., 1145 Nineteenth St., N.W., Washington D. C. for more details.

Sept. 28-Oct. 2. Electrochemical Society, Inc. Engineering meetings and symposia, Chateau Laurier, Ottawa, Canada. More details may be obtained from society headquarters, 1860 Broadway, New York 23, N.Y.

Sept. 28-Oct. 2. Pressed Metal Institute. Annual meeting, The Cloisters, Sea Island, Ga. For more information contact institute office, 3673 Lee Rd., Cleveland 20, Ohio.

Sept. 29-Oct. 3. American Society of Tool Engineers. Western Tool Show and Conference, Shrine Exposition Hall, Los Angeles, Calif. All details are available from Society headquarters, 10700 Puritan Ave., Detroit 38, Mich.

Oct. 1. Society of Plastics Engineers, Inc. Western New England Section. Regional Technical conference on "Plastics in Packaging", Hotel Statler, Hartford, Conn. For more data contact Blakely R. McNeill, c/o The Fuller Brush Co., 3480 Main St., Hartford, Conn.

. . . automation curriculum

To the Editor:

Professor Marshall's comments on my article in THE TOOL ENGINEER reflects a growing cleavage between two schools of engineering educators. On one hand, we have a group which favors engineering curricula built strictly around the engineering sciences. At the other extreme, we see strong leanings towards education which provides, in addition to a solid grounding in the basic engineering sciences, an opportunity for the student to apply this knowledge in the solution of mature technical problems as a means of firmly setting it in his mind preparatory for future professional assignments.

We also have a rather large and representative group of engineering educators who take a middle ground approach between the two camps. The latter individuals represent probably the largest segment of engineering educators today. Professor Marshall states that tool engineers are in the minority group and that their status has been somewhat degraded in the minds of other engineers. What he seems to ignore is the fact that tool engineering is going through an important renaissance and that a large percentage of our engineers who have graduated in mechanical and industrial engineering are in one way or another being absorbed into this activity. In fact, with the strong trend towards mechanization in industry, it is appalling to see how poorly engineering education has geared itself to meet the requirements for properly trained tool engineers.

We hear so much about specialization from individuals who know nothing about the subject that we sometimes wonder if it would not be best to return to the classical mechanical, electrical, and civil engineering curricula and drop areonautical, chemical, petroleum, textile and the many other new branches of engineering education that have developed to suit specific needs resulting from the growth in our country's gross national product and capacity to produce.

That Professor Marshall should question the benefit of advanced specialized courses is difficult to fathom. What difference does it make whether we talk about vibratory feeders, 4-bar linkages, Geneva drives, and other similar devices in relation to the application of engineering mechanics and machine design? I am confident that every machine design instructor employs practical problems in his courses. Why then should it be so difficult for better than average students to grasp the same fundamental concepts applied to slightly different types of problems. Accordingly, it would appear then that either engineering educators are incapable of grasping and communicating the significance of new and timely engineering materials, or our students are incapable of absorbing materials which have not been completely set down in engineering texts. To infer that engineering educators and students cannot possibly comprehend the implications and ramifications which can and do arise in industry until that person becomes a part of such a situation certainly leaves many engineering educators who work very closely with industry high and dry. Furthermore, it would indeed be a travesty for somehow during the student's formal preparation if he were not exposed to the realities of industrial life. I am confident a large number of my colleagues consider this a normal part of their responsibilities.

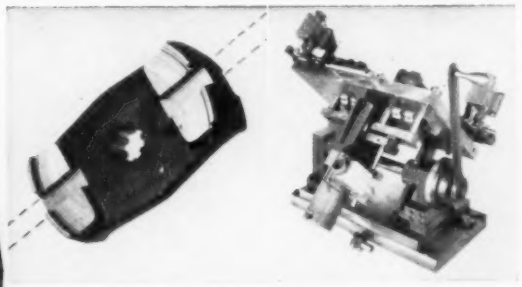
As for the necessary laboratories and facilities, rest assured that industry is only too happy to cooperate with schools in such undertakings. In our new automation program at the Pennsylvania State University, we have had what might be considered phenomenal luck in this respect. However, now that we have had an opportunity to take a hard look at why industry has so generously supported our automation program, we see that this is no more than a sincere interest on their part in fostering that type of education which will help prepare engineering students for professional activities which make up a strong extent of total engineering man hours paid for in this country today.

Last, but certainly not least, we feel that our automation program, while admittedly small, has filled an important void in the education of those students who plan to go into product and manufacturing engineering.

We are anxious for other schools to see what we are doing here at Penn State and for that reason will be very happy to provide specific details on our program to anyone interested.

Chester Linsky
Associate Professor
Automation Development
The Pennsylvania State University
University Park, Pa.

APEX BROACHES for HIGH QUALITY—LOW COSTS



JOB: Broaching key slots on both faces of forged universal joint couplings.
PROBLEM: Build two station tilt-up fixtures with hydraulic clamping, holder, sub-holders, and broaches to produce one completed part to .002 tolerance with each pass of ram.
RESULT: 100 finished parts per hour.

Apex Broaches, fixtures and holders assure higher production and greater precision because they are designed by experienced engineers and machined by craftsmen. Apex Broaches are tough and durable . . . designed with the largest safety factors possible. This means more parts per tool at lower production costs.

Broaching is the fastest, precision method for producing finished parts. For an intelligent appraisal of your production problem, send us your specifications and part print today.

THE PEAK OF QUALITY

apex broach company, inc.

6401 E. SEVEN MILE ROAD • DETROIT 34, MICHIGAN

Write today for your Apex brochure

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-143

Trade Literature

for free booklets and catalogs—use convenient request cards, page 137

Machining Plastics

Equipment and techniques required in machining Teflon plastic described in detail in 10-page technical report, "Machining TFE Resins"; illustrates finished components, describes selection and treatment of plastic stock; discusses types of cutting and forming tools, precautions on cutting edges, speeds, feeds and order of machining. Tri-Point Plastics, Inc., 175 I.U. Willets Rd., Albertson, L.I., N.Y. **L-8-1**

Vacuum Arc Furnaces

Savings in cost and space, reduced maintenance, maximum utilization and manufacturing quality made possible by vacuum-arc melting as a production technique are emphasized in 8-page publication GED-3599; describes principle used in designing furnaces and discusses components, controls and instrumentation of G-E's equipment; cutaway views show key features. General Electric Co., Schenectady 5, N. Y. **L-8-2**

This blade **could** have been packaged and shipped as a genuine MARVEL High-Speed-Edge Blade . . . and it **might** have performed to a customer's satisfaction. Instead, it was rejected and will be scrapped because inspection revealed a minute imperfection.

There's nothing unusual about this. Certainly, other hack saw blade manufacturers inspect their products, and undoubtedly reject blades for one reason or other, because they are trying to market the best blades they know how to make.

And that's the point—here at MARVEL, where the composite blade was invented and perfected over 30 years ago, we believe we know more about making high-speed-edge hack saw blades than any other maker. We've been at it longer, and the unequalled performance of MARVEL Blades on every kind of material is evidence that we're right.

Use MARVEL Blades on your power hack saws with perfect confidence that they have no equal. You can get MARVEL Blades at your nearby Industrial Distributor.

Write for the new MARVEL Cutting Tool Bulletin.

FB-1128

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE. • CHICAGO 39

Metal Cutting MARVEL SAWS
Better Machines—Better Blades

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-144

Lift Truck Attachments

Catalog 585 presents mechanical and hydraulic lift truck attachments illustrating 26 ways to get more use in the way of economy, efficiency and flexibility from equipment. Little Giant Products, Inc., 1571 N.W. Adams St., Peoria 3, Ill. **L-8-3**

Hydraulic Cylinders

Important engineering features, technical specifications and mounting information presented in 8-page Catalog 900 on Powrdraulic hydraulic cylinders; well illustrated by drawings. Hanna Engineering Works, 1765 N. Elston Ave., Chicago 22, Ill. **L-8-4**

Index Fixtures

Bulletin CIF describes and illustrates features and advantages of collet index fixtures for toolroom and production work; stresses versatility possible through interchangeability of units; includes prices. Hardinge Brothers, Inc., Elmira, N.Y. **L-8-5**

Temperature Difference Chart

Simple 8½ x 11 in. chart permits users of heat transfer equipment to determine quickly and accurately the logarithmic mean temperature difference Dean Thermo-Panel Coil Div., Dean Products, Inc., 616 Franklin Ave., Brooklyn 38, N.Y. **L-8-6**

Drafting Machines

Twelve-page brochure discusses unusual and advantageous features of German-made Isis drafting machines; well illustrated to explain construction and operation of this precision equipment and its accessories. The AJB Co., Box 1062, York, Pa. **L-8-7**

Hydraulic Cylinders

Handbook type Bulletin JH-104N covers important aspects of use of hydraulic power cylinders; contains not only descriptive information on various models in line, but useful academic cylinder data for engineers, designers and cylinder users, including chars, data on column strength, piston rod deflections, acceleration, factors of safety, cylinder forces, pressure losses in pipes, factors to consider in selecting cylinders etc. Miller Fluid Power Div., 2040 N. Hawthorne Ave., Melrose Park, Ill. **L-8-8**

Cap Screws

Advantages of new design socket-head cap screws which deliver unusually high load carrying capacity explained in 4-page folder; photos and charts illustrate various points. Box 786, Standard Pressed Steel Co., Jenkintown, Pa. **L-8-9**

Indicators

Expanded line of Em-re dial indicators described in 12-page Catalog D; shows new design features responsible for indicators' accuracy and repeatability; well illustrated with drawings. Petz-Emery Inc., Pleasant Valley, N. Y. **L-8-10**

Production Control System

Illustrated 8-page brochure, "Cut Production Costs with Hancock Telecontrol," discusses advantages of this production control system in extending automation benefits to general manufacturing systems; explains in detail what the system is and how it functions. Control Systems Co., Div. of Hancock Industries, Inc., Jackson, Mich. **L-8-11**

Special Purpose Tools

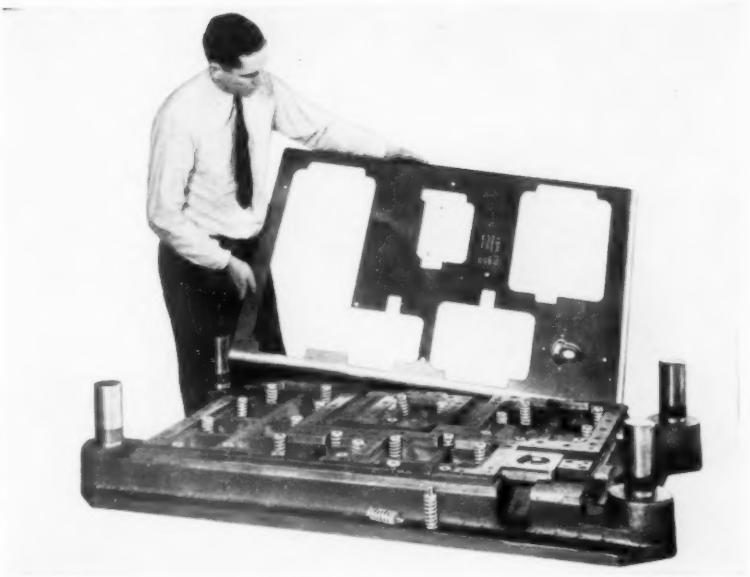
Automated special machine tools for low, medium and high-production operations are described in extensively illustrated 20-page brochure which divides special metalworking machine tools into specific generic types and outlines production parts, operations and rate schedules to which they are applicable; also covers transfer type and center column machines for high production plant schedules as well as those for performing balance milling and cut-off operations. High production automation concepts of parts in transfer and automatic in-machine assembly described and illustrated in detail. Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich. **L-8-12**

Steels

Investment cast properties of stainless and low alloy steels described in 40-page booklet; lists chemical compositions, applicable AMS specifications and mechanical properties; including hardness, impact strength, short-time tensile data and stress-rupture data. Literature Distribution Section, Haynes Stellite Co., Div. of Union Carbide Corp., 30-20 Thomson Ave., Long Island City 1, N. Y. **L-8-13**

Hones

Four-page illustrated folder stresses features and advantages of size control hone; explains engineering details and production points. Jes-Cal Co., 31485 Groesbeck Hwy, Fraser, Mich. **L-8-14**



the **STRIPPIT** that gave us our name...brings you

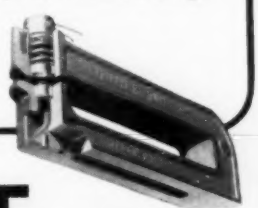
lower tooling costs!

A REVOLUTION IN DIE-MAKING. The famous "Strippit," invented by Wales Strippit Company, saves tool engineers and die-makers endless hours of designing and building stripping mechanism into die sets. These compact, telescoping spring-and-retainer units provide standardized stripping pressures for uniform stripping of blanks from dies. Strippits eliminate spring grinding . . . stripper bolts . . . drilling and counterboring for stripper bolts . . . boring spring pockets . . . permit use of thinner, easier-to-machine stripper plates . . . eliminate turning over the punch holder and die shoe castings after the back sides have been planed. Strippits pay for themselves many times over on every job.

LOWER COST MULTIPLE PIERCING AND NOTCHING.

Strippit self-contained hole punching and notching units, provide the most economical way to notch up to ¼" mild steel and punch flats, structurals and extrusions up to ¾" mild steel. These units are quickly set up in any pattern, placed in the press without loss of press time and actuated by the ram. Interchangeable standard or special tools . . . fast setup changes . . . re-usability of all units . . . give you high production plus flexibility for quick, economical design changes. Write today for complete engineering details and if you desire, a demonstration by a Strippit mobile unit at your plant. No obligation, of course.

Warehouse stocks in Chicago and Los Angeles.



A UNIT OF HOUDAILLE INDUSTRIES, INC.

WALES **STRIPPIT** COMPANY

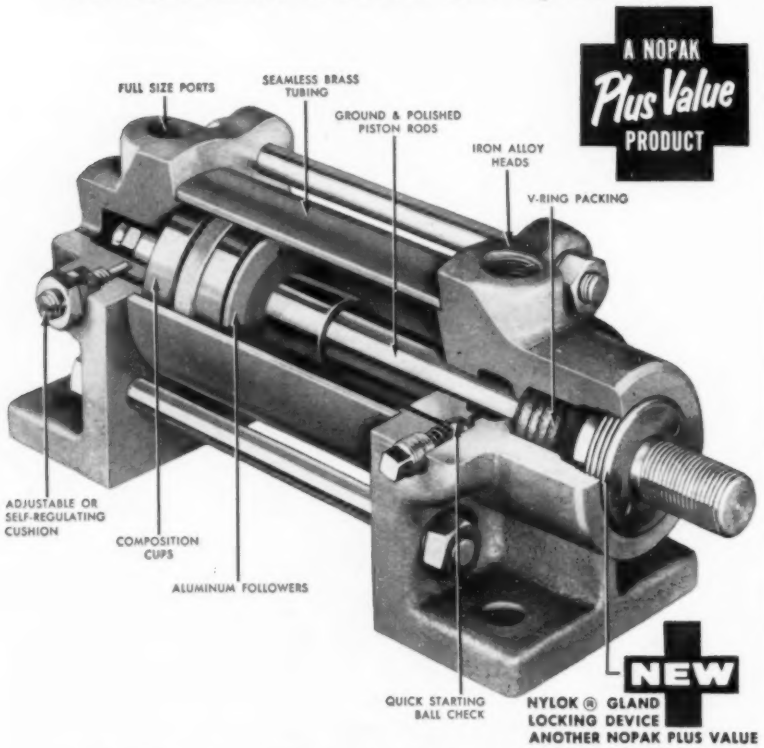
211 Buell Road, Akron, New York

Manufactured in Canada by Strippit Tool and Machine Limited, Brampton, Ontario

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-145

Plus Value Performance

is built into NOPAK Air Cylinders



Class 1 and 2 Air Cylinders

Pressures to 250 P.S.I.

Features? Check These—

- **CHOICE OF CUSHIONING ACTION:** All Class 1 and 2 cylinders are available with non-cushioned, self-regulating or adjustable cushioned heads on either or both ends.
- **QUICK STARTING:** Quick opening ball-check valve assures starting under full power.
- **LIGHTWEIGHT COMPONENTS:** Piston follower and follower-ring made of aluminum, wherever suitable, reduce piston weight up to 60%, result in faster starting, more power, longer cup-packing life in horizontally mounted cylinders, reduced impact.
- **PISTON PACKING TYPES:** Standard piston assemblies utilize dependable composition self-sealing cups, for air, oil or water service. Other types available include:
  - Leather cups for medium and low pressure
  - Impregnated fabric cups for high pressure oil or water
  - Graphite impregnated cups for high temperatures
  - Piston-ring type for special applications
- **SELF-LOCKING PACKING GLAND:** New gland design utilizes Nylok ® for positive locking.
- **SELF-COMPENSATING V-RING PACKING:** Requires no adjustment; assures longest possible trouble-free operation.
- **BRASS TUBING:** Hard drawn, seamless, straight and concentric; impervious to corrosion.
- **CYLINDER HEADS:** Iron Alloy for durability and long life.

Shelf-Stock Service on Standard Models

NOPAK Class 1 Self-Regulating Cushion Air Cylinders are available from stock in a range of bore sizes and stroke lengths from 1½" x 1" to 8" x 15" in 6 Standard Models. Ask your NOPAK representative for the latest NOPAK Shelf Stock listings, or they will be sent with your request for Catalog 101-A covering the complete line of NOPAK Air Cylinders.

® Registered Trade Mark, The Nylok Corp.

Representatives in Principal Cities

NOPAK VALVES and CYLINDERS

Galland-Henning NOPAK Division • 2750 S. 31st Street • Milwaukee 46, Wis.

A8-635-R

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-146

Stamping

Data file on use of Strenes metal, a chromium-molybdenum alloyed gray iron, in stamping, describes and illustrates applications of the metal in the stamping industry and includes bulletins and data sheets; particular reference is made to drawing and forming die applications. Request direct from the Advance Foundry Co., 107 Seminary Ave., Dayton 3, Ohio.

Handling System

A handling system engineered for maximum flexibility to meet changing in-plant operation illustrated and described in Case History Report No. 37, based on operations at Midland Steel Products Co. where it handles nearly 250,000,000 lb of material each year within and between five adjacent buildings. The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, Ohio. **L-8-15**

Chemical Milling

Sixth in series of design bulletins for design and production engineers outlines quality control standards set up by company to help engineers gage what chemical milling can do; gives stages at which inspections are performed, tolerances that are obtainable and surface finishes that will result on various metals. United States Chemical Milling Corp., 1700 Rosecrans Ave., Manhattan Beach, Calif. **L-8-16**

Titanium Welding

Comprehensive evaluation of successful welding methods presented in illustrated 32-page handbook, "Titanium Welding Techniques"; outlines do's and don'ts of welding, and covers details of fusion welding equipment and procedures, resistance welding equipment and procedures, study of typical weldments, and methods for evaluating weld quality; also outlines welded joint designs, mechanical properties of weldable grades of titanium and recommended settings for open-air machine welding. Titanium Metals Corp. of America, 233 Broadway, New York 7, N.Y. **L-8-17**

Drafting Room Pointers

Well illustrated with application diagrams, 12-page booklet, "Short Cuts and Savings with Kodagraph Reproduction Materials," outlines ways in which such materials can be used to protect original drawings, simplify print distribution, restore old and worn drawings, reproduce blueprints and direct-process prints, speed revisions, permit combining of standard designs, and save drafting time. Graphic Reproduction Div., Eastman Kodak Co., Rochester, N.Y. **L-8-18**

technical Shorts

RESULTS of work done for Sherritt Gordon Mines Ltd. indicate excellent mechanical properties can be achieved by roll compacting nickel powder into strip. The report based on the work was made by Dr. J. A. Lund of the University of British Columbia. In the study, a Stanat horizontal metal mill equipped with 6 in. diam x 6 in. face rolls produced green strip density varying from 77 to 88 percent of the theoretical density of pure nickel.

Better Properties From Compacted Nickel Powder

After the initial roll compact, the material was passed through a sintering furnace where temperatures of 1900 to 2250 F were used for corresponding times of 30 to 50 minutes. The sintered material then was processed on a Stanat 2-high/4-high combination rolling mill with ¾ in. diam work rolls and 4 in. diam x 6 in. face width backup rolls. A total cold reduction of 65 to 75 percent was achieved in the thickness of the sintered strip with intermediate and final annealing at 1600 F for 30 minutes.

With this treatment, strip has been obtained with values of density, tensile strength and ductility that are at least as high as those reported for cast, rolled and annealed pure nickel. Densified and annealed strip was reduced up to 45 percent in thickness by cold rolling without annealing. Tensile strength of the strip rose to 95,000 psi with the treatment.

* * *

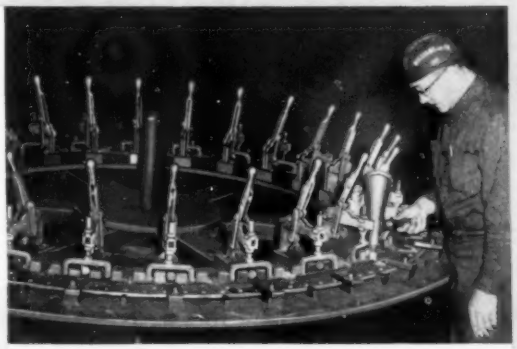
THREE films have been made available to industry for a variety of purposes. Among them is a sound slide presentation entitled "Prosperity—Our Most Powerful Weapon," which is prepared for employee audiences and backs up necessary cost-cutting efforts to win acceptance for management insistence on better performance. Information on showing this film is available from Hugh Smith, Associate Membership Div., Research Institute of America, 589 Fifth Ave., New York 17.

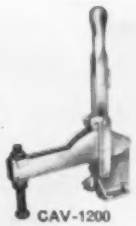
Industrial Films Explain Problems And Techniques

A color-sound 16mm motion picture, designed for viewing by engineers, illustrates fundamentals of modern broaching. The 30-minute film shows operation of simple, basic broaching machines as well as most intricate, fully automatic high production. Close-up view of tools and fixtures in operation help the viewer understand simplicity of the process while indicating the possibilities for broad adaptation. Information on gratis availability of this film may be obtained from Director of Educational Program, The Lapointe Machine Tool Co., Hudson, Mass.

Third film is the 16mm sound motion picture on "Forging in Closed Dies." This authoritative story of modern forging methods, presented by the Drop Forging Association, explains each kind of forging process, design and making of dies, variety of metals used and their selection. Distribution is through Modern Talking Picture Service, Inc., 3 E. 54th St., New York 22, N. Y.

CLAMP QUICK...
HOLD TIGHT...
RELEASE FAST...





KNU-VISE CLAMPS AT GAR WOOD INDUSTRIES, INC.

One of the biggest problems Gar Wood has in gear welding is fast, positive clamping of materials with large variations in thicknesses. Gar Wood chose Knu-Vise "cam action" type clamps for top production and rock-bottom costs. There are 24 clamps to a fixture—with loading and unloading as fast as a man can pull the clamp handles. The work is held rigidly to keep quality high and to reduce rejects.

Whenever you need fast, positive clamping action on jigs and fixtures, or anywhere, you can find a Knu-Vise clamp that will do the work fast and easily. There are more than 150 types of Knu-Vise clamps and pliers designed to do almost any holding job. Every one is a ruggedly built production tool made to last. They are hand or air operated. Write today for more information.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS | LAPEER MANUFACTURING CO.

3053 DAVISON ROAD
LAPEER, MICHIGAN

WESTERN DIV.: PECK and LEWIS CORPORATION
4436 Long Beach Ave., Los Angeles 58, Calif., ADams 3-7146

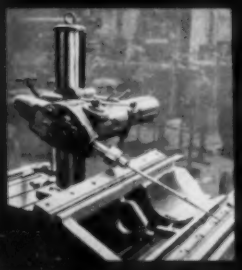
CANADIAN DIV.: HIGGINSON EQUIP. SALES LTD.
1131 Pettit Road, Burlington, Ontario

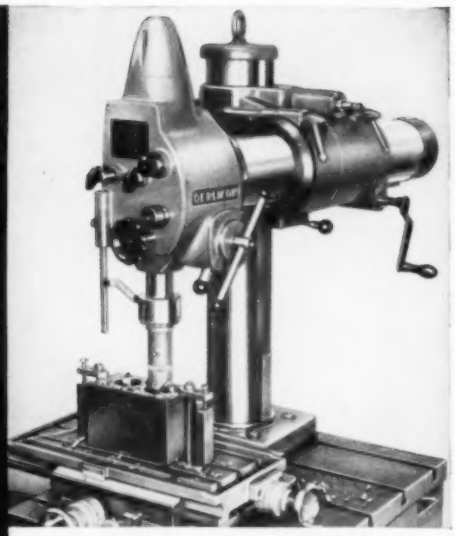
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-147

OERLIKON

UB 2
ALL ANGLE
PRECISION
BORER

The UB 2 performs hundreds of general and spezialized workshop operations - drilling, milling, countersinking, tapping, precision and center boring, reaming, facing, trepanning, etc.





- Radial swivelling arm and a freely swivelling head allow handling of any job, even in awkward positions.
- Boring head can be canted to any angle (360°) and accurately latched vertically and horizontally.
- Spindle speeds variable from 30 to 3070 rpm.
- Accessories include precision chuck, tapping heads, collets holder, adjustable boring head, facing and turning head, trepanning tool, boring bars, etc.
- Portable - take it right to the job.

Write for detailed information and prices to:

Olkon Corporation Machine Tool Division
13823 West Eight Mile Road Detroit 35, Michigan
(Some exclusive territories still available)

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-148-1

BENTLEY
10 YEARS OF DEPENDABLE SERVICE TO INDUSTRY

Here is the most priceworthy quality milling machine... the NEW VICTORIA U2 RAPIDMIL

by ELLIOT of LONDON

Larger Working Surface: 48" x 11¾" ● *Longer Travels:* 30" L., 10" X. & 16" V. ● *Faster Operation:* RAPID Traverses in all directions ● *Complete Safeguards:* Overload Feed Clutches etc. ● *Up-to-date Construction:* Built-in Backlash Eliminator, 4-Bearing (Timken) Spindle etc. ● *Wider Ranges:* Feeds: .65"-21.5" min., Speeds: 30-1500 RPM (2 ranges)

Vertical, plain and universal models available from #0 to #4

Delivery from stock and Complete Service Available

$5,225
F.O.B. New York

Write for name of nearest dealer and literature to:

BENTLEY INDUSTRIAL CORP.
41 East 42nd St., Dept. C-8, New York 17, N. Y.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-148-2

TOOL ENGINEERING in Europe

By M. Kronenberg
Consulting Engineer
Cincinnati 6, Ohio

Truing Grinding Wheels

The effective surface and the shape of a grinding wheel are among the significant factors influencing the economy of grinding, according to an article published by G. Pahlitzsch and W. Thoeing in the May, 1958 issue of *Werkstatt Technik und Maschinenbau* under the title: "Neuere Untersuchungen ueber den Abrichtvorgang beim Schleifen."

During research by the authors, the effective depth of surface roughness (WRT) of the grinding wheel proved to be a very useful new concept for measuring the effect of the shape of the grinding wheel surface. This quantity depends primarily on the wheel truing.

The variation in WRT during grinding was measured in the tests; also its relation to truing conditions. It was shown that the WRT increases when the feed (or table speed) is increased and also when the depth of cut per pass is increased. The effect of table speed is, however, more prominent.

Another important factor is the shape of the truing diamond. The larger the included angle at the point of the diamond, the smaller the WRT. Likewise, the greater the angle of inclination of two otherwise equal diamonds, the smaller the WRT. The use of multipoint dressers instead of a single diamond resulted in a reduction of the WRT. This is caused by the effect of the multiple cutting edges and the smoothening due to the plastic bond.

The authors recommend a low WRT of the grinding wheel surface if a smooth surface is desired. This can be obtained by dressing at a low table speed with small increments in depth of cut, a dull diamond and a large angle of inclination. The increments in depth of cut have the least effect.

The dressing time increases, however, when the table speed is low. It is therefore most economical to obtain

a high quality surface finish by grinding with a dull diamond at large angle of inclination. The same result can be obtained by use of multiple-point dressers. If a rough cut is desired, the "rules" are reversed.

Centerless Microfinishing

Centerless microfinishing has proved to be practical for finishing crankshafts, shafts, axles and similar cylindrical parts as discussed by E. Thielenhaus in *Industrieblatt* 1958, Vol. 58 (2), pp. 37-40 under the title: "Die Vorteile spitzenloser Aussenfeinhon Maschinen fuer die Bearbeitung zylindrischer Werkstuecke."

It is possible to machine plane slotted surfaces by holding the workpieces between two rollers which also serve as conveyors. Speed and feed of the rollers are adjustable at infinitely fine increments. The machine can take various honing tools, oscillating at frequencies that can be adjusted between 500 to 2000 strokes per minute. The tool pressure can be varied continuously.

Measuring Metal Shaping Forces

In order to avoid the difficulties of leakage often associated with hydraulic gages used for determining forming forces on presses, H. Gross and R. Beck have developed an instrument that uses a rubber-like substance in lieu of a hydraulic oil. They describe their instrument and tests run with it in *Fertigungstechnik*, No. 6 (9), pp. 409-411, under the title: "Betriebliche Kraftmessung in der spanlosen Formung, insbesondere mit dem Druck Uebertragungs Mittel PVC 15/85."

The rubber-like substance, designated "PVC 15/85," is elastic at room temperature like soft rubber, but has less elasticity. It is not compressible and is not affected by oil. It transmits pressure uniformly. In the case of a hydraulic cylinder, the clearance between piston and cylinder should be less than 0.003 inch in order to avoid any leakage of the rubber-like mass, even when the height of the piston is small. PVC 15/85 must be poured into the gage when it is liquid in order to obtain a uniform filler, free of air bubbles. The best way is to heat the gage to approximately 320 F and pour the mass into the gage after heating it to 285-320 F.

The calibration data can be represented by straight lines passing through zero and are reproducible after about 150 applications. Pressures up to 4250 pounds per square inch can be measured in cases of slow load applications.

Hardness Testing

Among the papers recently published on hardness testing, the articles by H. Bueckle in *VDI Berichte*, Vol. 11, pp. 9-27 and by L. Koch, G. Hein and S. Keste, published in *N Metall*, Vol. 11 (12), pp. 1038-1045, will be of interest. The first article deals with the relation between target and method of microhardness testing under the title: "Beziehungen zwischen der Zielsetzung und dem Messverfahren der Mikro Haerteprueфung."

Although the indenters used for such testing give geometrically similar impressions, microhardness depends on the load, as distinct from macrohardness. The author discusses the various methods used for extrapolation and concludes that none is satisfactory, due to errors such as imperfect polish, vibrations, errors in reading, variations in speed, errors due to the sample itself and others. Since the volume affected by indentation is much greater than the visible indentation, the effect of inhomogeneities in the sample increases sharply with the size of indentation. Microhardness is defined as ranging from loads of 200 to 1200 grams, while macrohardness ranges above 3000 grams of load.

Various formulas for correlating microhardness and macrohardness data are discussed; also formulas for calculating the errors associated with every indentation. It is pointed out that microhardness methods can also be used for testing surface layers and special methods of evaluation are described, as well as instruments used for these tests.

The second article, entitled "Anwendungs Biespiele fuer neuere Verfahrens Techniken in der Metallographie" describes new developments in various metallographic techniques, including the polishing of taper sections. Surface roughness can be tested by an interference adapter attached to the metallographic microscope described. The objective has 15X magnification and can measure roughness within the range of 0.4 to 40 microinches.

Another article dealing with microhardness, although not with that of metals, is of interest because experiments in other fields of engineering may often have a bearing on tool engineering as well. The microhardness of glass surfaces is discussed by P. Joos in *Zeitschrift fuer angewandte Physik*, 1957, Vol 9, No. 11, pp. 556-561. Glass in bulk is a brittle material and fractures before any plastic deformation has taken place, according to traditional concepts. The author describes tests to determine the microhardness and comes to the conclusion that plastic deformation takes place in glass long before cracks occur. He opines that the presence of water produces a layer which reduces the mechanical strength of glass. His tests with electron microphotography show how the trace of a scratch changes shape and size as the pressure of water is increased.

TOOLING FOR THE SPACE AGE!

ASTE

WESTERN

TOOL

SHOW

AND CONFERENCE

SHRINE EXPOSITION HALL

LOS ANGELES, SEPT. 29-OCT. 3

●

For more information, write:

AMERICAN SOCIETY OF TOOL ENGINEERS

10700 PURITAN AVE.

DETROIT 38, MICH.

AMERICAN SOCIETY

TOOL SHOW CONFERENCE '58 SEPT 29-OCT 3

OF TOOL ENGINEERS

introducing a

NEW

OLOFSSON

HEAVY DUTY PRECISION BORING MACHINE

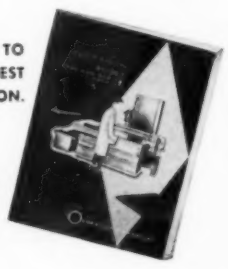
Designed for better precision finishing...semi-finishing...and roughing of large, bulky parts

This newest in the line of Olofsson Precision Boring Machines, the Model 22, is designed for more profitable heavy-duty rough and finishing boring, facing, chamfering, turning and grooving operations. Put one to work . . . and profit potential goes up. Because of the versatility of its new design, operating costs go down.

MODERN, WITH 22 QUALITY-DESIGN FEATURES, the Olofsson Model 22, weighs a hefty 7,600 lbs., untooled; and incorporates such design features as:

- *Extremely low ratio, height to width, of spindles to ways.*
- *Hardened and ground Alloy Steel flat and vee ways.*
- *Extra-large fixture mounting provides maximum stability for mounting large work pieces.*
- *Integral chip chutes completely surround any fixture tooling.*

WHATEVER YOUR PRODUCTION REQUIREMENTS. IT WILL PAY YOU TO FULLY INVESTIGATE THE MODEL 22. CONTACT YOUR NEAREST OLOFSSON REPRESENTATIVE. Or, if you prefer, write direct to OLOFSSON.



THE OLOFSSON CORPORATION

2731 LYONS AVENUE, LANSING, MICH. *Phone:* IVanhoe 4-5381

MANUFACTURERS OF PRECISION BORING AND SPECIAL MACHINERY

Tech Digests

Space Age Materials

By E. C. Bishop

Engineering Mgr.
Materials Mfg. Dept., Metals Plant
Westinghouse Electric Corp.
Blairsville, Pa.

Technical advances in such fields as aviation, missiles, electronics and nuclear energy have created a need for new materials, particularly metals, that previously have been little more than laboratory curiosities. These new structural materials must be able to operate at such extreme temperatures, that today's commercially available alloys—developed to withstand up to 1800 F—simply will not stand up.

Iron, cobalt, and nickel—the present building blocks for virtually all our high-temperature alloys—have relatively low melting points, below 3000 F. There are more than a dozen metals with higher melting points, some almost twice as high as iron. Many of these can be ruled out for commercial purposes simply on the basis of their scarcity in nature; but seven metals remain whose availability in nature makes them reasonable sources for future high-temperature alloys. Of these, tungsten, molybdenum, columbium (or niobium) and chromium appear to offer the best future.

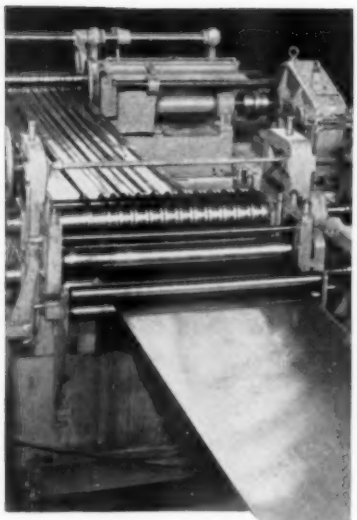
Alloys of these new elements have obvious applications in a nuclear propulsion system for missiles. For applications in nuclear-powered aircraft a structural material would have to have high-temperature strength and corrosion resistance, but at the same time have low-neutron "cross section," or a low tendency to absorb neutrons from the nuclear fuel. The development of niobium shows the best combination of these properties.

In addition to their use as bases for alloy systems, these metals can be used at higher temperatures as ceramics—oxides, nitrides, carbides, borides, or silicides of metals. These materials have not been previously thought of as structural materials for high-temperature use due to their brittleness, but recently it has been found that under certain conditions, some formability can be obtained in ceramics. The ceramic materials must also be able to operate at subzero temperatures, possibly even close to absolute zero. At these low temperatures most of these materials and many of the present-day alloys, exhibit no ductility and are subject to brittle fracture. Therefore, a major part of the program of developing "extreme-temperature" materials is concerned with studying their behavior at very low temperatures, including the transition from ductile to brittle fracture.

The big problem in developing alloys of tungsten, molybdenum, niobium, and chromium, lies in the fact that at, or even near, their melting point they react with air, most other gases, and any known refractory material. Conventional methods of melting, hot working and heat treating that are done either in air or make use of conventional refractories are impossible to apply to these metals.

The most successful of the new melting techniques is the cold hearth melting or arc-casting furnace, *Fig.* 3. Raw material to be melted is compacted into an electrode form and melted under

Fig. 1. Conical-shaped induction coil produces upward force, holding and melting metal sample in space.



Greater Profit and Operational Flexibility with a YODER SLITTER

Even if you use less than 100 tons of varied strip sizes per month, it will pay you to investigate the savings that are possible through the operation of a Yoder slitter. Savings per ton increase rapidly as coil size and width of strands decrease...so much, that under average operating conditions, a slitter will pay for itself in a few months.

From a small stock of standard mill-width coils, a Yoder slitting line enables you to meet unexpected demands, or to supply "special" width slit strands in a matter of a few hours. This flexible operation increases plant efficiency, resulting in savings of time and money through simplified production planning and greatly reduced strip inventories.

The Yoder line includes slitters of every size and capacity for coil or sheet stock. Send for the all-new, 1958 edition of the Yoder Slitter Book. It is a comprehensive text on the mechanics and economics of slitter operations with time studies, cost analyses, and other valuable data. Write to:

THE YODER COMPANY
5525 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING ROTARY SLITTING LINES

INDICATE A-8-152

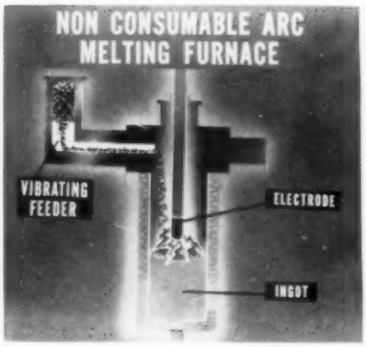


Fig. 2. Schematic diagram of non-consumable-electrode vacuum-arc furnace during operation.

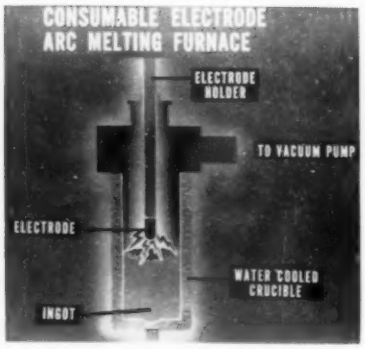


Fig. 3. Schematic diagram of consumable-electrode vacuum-arc furnace for cold hearth melting.

the action of an arc into a water-cooled copper crucible in an evacuated chamber. Contamination by either air or a refractory crucible has thus been avoided to a great extent. One drawback to this method of melting is the need to form the raw material into an electrode, usually done by compacting a sponge or powdered form of it. The electron bombardment furnace (or non-consumable electrode furnace) circumvents this problem by substituting a tungsten electrode for the compacted metal electrode. *Fig.* 2. The heated tungsten filament is a source of electrons which are accelerated toward the bath by maintaining a high voltage between the filament and the bath. The actual metal to be melted is then fed into the furnace in granular, shot, or powdered form and melted by the energy of the high-speed electrons striking it in the bath.

The cold-hearth melting method has been used commercially to melt titanium and zirconium-base alloys, as well as iron and nickel-base high-temperature alloys in ingots of 3000 to 5000 pounds. The electron bombardment furnace has been used experimentally to melt some of the higher melting metals.

Even these methods have the limitation that some contamination of the melt occurs by contact with the copper crucible. This impurity can be serious when extremely high-purity metals for research studies are needed.

The melting crucible is eliminated entirely in a new process called levitation melting. Induction heating is used to melt the metal but the coil is conical shaped, which means that the resultant electromagnetic forces created by the coil have a net upward push. By careful juggling of coil dimensions, power input, and other factors, the coil will actually suspend the metal in mid-air, so to speak, while it is molten. *Fig.* 1. For most metals, this melting is done in a container filled with an inert atmosphere, such as argon, or even in a vacuum. Not only can metal be melted with this technique, but by cutting the power off suddenly, the molten mass can be dropped into a small ingot mold to form a shaped casting.

All these methods have been designed to maintain the purity of the starting metal. But what if the purity of the starting material is somewhat questionable to begin with? How can a metal be melted and refined at the same time? Zone refining is a technique which does just that. Essentially the method consists of placing a bar of the metal to be purified in a refractory boat and slowly passing these two through a small cylindrical induction coil. As the bar passes through the coil, a small segment of it is melted and this molten zone moves along the bar as the bar passes through the coil. By making repeated passes of this type, impurities in the metal, which tend to lower its melting point, are gradually pushed to the "finish" end of the bar while impurities

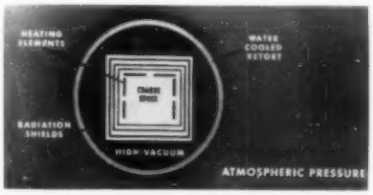


Fig. 4. Theory of cold-retort vacuum heat treating furnace is simple. Surround heating elements with baffles that concentrate heat on work. The baffles are used as heat reflectors in place of the normal refractory insulation in conventional furnaces.

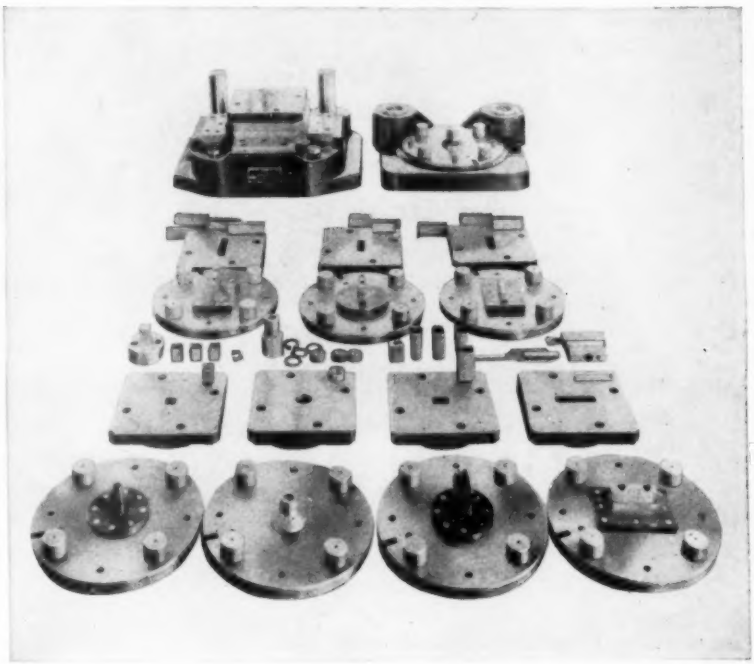
which raise its melting point are moved toward the "start" end of the bar. This method incidentally is not just a laboratory curiosity. All the germanium and silicon being used to make transistors, rectifiers and similar devices for transistorized radios and hearing aids, had to be purified by just such a zone-refining process.

Purification of reactive metals such as titanium, zirconium, niobium, which would react with the refractory boat, has been accomplished by combining levitation melting and zone refining. The conical coil of levitation melting supports the molten zone of the bar while the bar is moved through the coil to obtain zone-refining action. Prior to this operation several longitudinal fins have been machined on the bar that do not melt during the process since their large surface area permits them to cool more than the center of the bar. Hence, they act as a cage which together with the surface tension of the metal act also to contain it. This process is called cage-zone refining.

It is natural to also expect contamination of a metal during forging, hot rolling and heat treating, *Fig.* 4, even though temperatures are appreciably lower than those while melting. As far as hot-working operations are concerned, it is staggering to visualize performing them in vacuum, so the first approach to solving this problem has been to do the job quickly. Literally, the hot-working operation is performed as fast as possible, to minimize the length of time the metal is in contact with air.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

But these measures are simply stopgap methods and do not get around the basic problem of how to hot-work materials without any contamination from air. This would require that the heating, forging and rolling equipment be located in a room where air can be excluded. Fantastic as it sounds, this is being done, on a rather sizeable scale. Since leaks would make it very difficult to keep the room under vacuum, the alternative method of filling it with an inert gas such as argon, is employed, and the operators don space suits with their own oxygen supply in order to move about in the room and run the equipment. An interesting sideline is



ALL THIS FROM ONE BASIC DIE

One basic die with 8 different sets of cutting members was used to trim the 8 parts shown. Some are round, some are square, some are rectangular and the one in the die is irregular. Depths vary from ¼" to 3". **Only one basic die is used.**

A Brehm "Shimmy" Die with angular cams can be designed for almost anything you need trimmed — fountain pen ferrules, artillery cases, watch cases, burial vaults, automotive, kitchen, radio and television accessories and parts. *Send part prints for quotation on Brehm "Shimmy" and related dies, such as blank, form pierce.*

VULCAN TOOL COMPANY THE SHIMMY DIE REGISTERED U.S. PATENT OFF.

Brehm® trimming dies

ENGINEERING • PROCESSING • BUILDING • TOOLS
DIES • SPECIAL MACHINES • VULCANAIRE JIG
GRINDERS • MOTORIZED ROTARY TABLES • BREHM
"SHIMMY" AND RELATED DIES • AUTOMATION

VULCAN TOOL CO., YOUR TOOL ROOM IN DAYTON
BREHM DIE DIVISION • 733 LORAIN AVENUE • DAYTON 10, OHIO

VULCAN tools

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-153

the fact that originally it was planned to have the operators wear only a plastic bubble helmet with oxygen supply and no suit, but simple calculations soon demonstrated that the perspiration from their bodies would contaminate the atmosphere with enough water vapor that could result in serious contamination of the metal being worked. As a result, it was necessary that they be fully clothed in suits so that neither water vapor nor exhaled air could enter the room.

Special problems may arise in machining these new metals due to their unusual problems. For example, although normal machining operations can be applied, machining rates may be slower because of the metals' high hardness or work hardening rates. Machining of molybdenum, which has a considerably lower coefficient of expansion than most machining tool alloys, can cause binding of drill bits and reamers, unless both the tool and work are kept cool. With other materials special tools, possibly ceramic ones, may be required and undoubtedly electrical spark machining will find wider applications for hard materials.

A new method of machining, recently developed in Germany, may find wider application with these new materials, especially ceramics. In principle, this technique, called electron beam machining, is related to electron bombardment melting. A beam of high-speed electrons is carefully focused on the work to drill a hole or actually cut out a complex pattern. To date, this method has been used only on a small scale and principally on ceramics and diamonds, but if new materials are developed that cannot be machined by conventional methods, some modification of electron beam machining may be adopted.

Based on a paper presented at the 22nd Annual Machine Tool Electrification Forum, Buffalo, N. Y., sponsored by the Westinghouse Electric Corp., Pittsburgh, Pa.

▼ ▼ ▼

Training Maintenance and Engineering Personnel

By Ralph G. Smith
Labor Relations Dept.
Dow Chemical Co.
Midland, Mich.

Training of maintenance and engineering personnel is a marvelous tool to help increase the efficiency of operations. Often a company is much wiser to accelerate its training efforts rather than curtail them when it is faced with a necessity to cut costs. If there is a proven need for training and the training program is sound and practical, then it is shortsightedness on the part of management to curtail or eliminate training as a means of cutting plant costs! To do so is to eliminate the very tool that could cut plant costs!

Based on a paper presented at the Semiannual Meeting, Detroit, Mich., June 15-19, 1958, of The American Society of Mechanical Engineers, 29 W. 39th St., New York 10, N. Y.

▼ ▼ ▼

The Computer in Job-Shop Production Control

By W. Bruce Pirnie, Jr.
Manager of Production
Machine Tool Div.
Jones & Lamson Machine Co.
Springfield, Vt.

Use of electronic data-processing equipment makes operation of production-control systems in the large job shop more effective than has been possible ever before. The speed and accu-

Simple...Positive...Faster...Accurate
Indexing with TRIG-R-DEX

Trig-R-Dex is a completely new concept in manual indexing that simplifies and speeds straight or spiral operations.

To index—simply grasp the Trig-R-Dex handle, push down on the trigger button and move the handle until index pin engages the next hole, pull handle to stop position and you have indexed one increment. During work processing operations, the Trig-R-Dex handle always remains stationary. But, the index plate is keyed to the driver holding the work center . . . this assures the index plate, center and workpiece turn as a unit.

By selecting proper index plate, both right- and left-hand operations having from one to ten spaces can be accurately indexed. Changing from one index plate to another is extremely easy and takes but a couple minutes.

Because Trig-R-Dex is simple in design, of rugged construction, easy to operate and precision made, it will give years of accurate, trouble-free service, reduce costs and boost your production.

U.S. PATENT NO. 2,711,324

For further information, write to:

DETROIT REAMER & TOOL COMPANY

780 W. MAPLE ROAD • P.O. BOX 174 • BIRMINGHAM, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-154

racy of the computer processing masses of detailed information take a lot of the guesswork out of planning shop operations, permitting shop managers to make sound decisions based on known and evaluated facts.

The computer is a tool; if properly used it will give outstanding results. When used in a system that is not based on sound principles, even the best computer will give disappointing results. The basic principles of controlling work in process are few and simple: schedule all the work, dispatch according to schedule, load to known capacities, know where the work is, keep track of its progress, and take action accordingly.

The secret of production control lies in the man, and not in the machine.

Based on a paper presented at the Production Engineering Conference, The American Society of Mechanical Engineers, 29 W. 39th St., New York 39, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Launching a New Plant

By W. H. Dorrance
Manager
Plant Engineering Dept.
General Products Div.
Ford Motor Co.

The successful launching of a new plant naturally divides into three phases: (1) preconstruction or planning period, (2) preproduction or preparation period, (3) launching—turning the wheels over and building up to volume production.

Each of these phases should be adequately covered by program and by funds. Each of these phases should be scheduled and continuously reported to management. Detailed controls must be set up both as a fiscal and an engineering policy.

During our launching period, with the gradual build-up of machines in production, many problems arose which would have proved costly if allowed to become repetitive. Some of the more significant were:

1. Differences of opinion as to the scope of the contractors' work which often led to emergency field orders. If these differences resulted from

Back of a *Chicago Rivet*
Is an Organization That Really Serves

The *RIGHT* rivet, plus the *RIGHT* riveting machine will produce a fastened assembly at the *RIGHT* low cost

The correct combination of rivet and machine requires expert knowledge available to you through Chicago Rivet engineers.

Anticipated production, type of materials to be fastened, assembly shape and its expected service life are factors to be considered. Decisions must be made on a rivet metal or alloy. Type and size of rivet, shape of head and shank, depth of tubular section must be all determined. Are indexing fixtures and multiple setters indicated? Can a standard rather than a special rivet be used? These are the type of questions Chicago Rivet Engineers are daily answering for industry. Their recommendations are available to you without cost. We suggest you send a blueprint or sample assembly with your inquiry.

There are *Chicago Rivet* Machines that will set

1
2
3
4
5
6

Tubular or Split Rivets At a Time

Chicago Rivet & MACHINE CO.
960 South 25th Avenue
Bellwood Ill. (Chicago Suburb)
Branch Factory: Tyrone, Pa.

FOR YOUR FILES
Rivet catalog describing 1388 standard tubular and split rivets and 26 single and multiple automatic rivet setters.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-155

insufficient information on the data sheet, or from company initiated changes, the field order was priced out and covered by bulletins.

2. Interruptions in installation due to the slow procurement or delivery of essential machine parts, such as special fittings, starters, hydraulic units, etc. In many instances we were able to expedite by placing the resources of the company's purchasing agents on the items.
3. We experienced the tendency of well-meaning company personnel to give instructions to the installation crews. This was easily corrected by agreement with the contractors' supervision and instructions to company people.
4. Occasional interruptions in power or process services were encountered due to the contractor pulling switches or closing valves incident to his work without proper notification. This problem should be met with a spirit of cooperation on both sides.

The concepts which added together will contribute to a successful plant launching are:

1. Early planning: Even before money is available a certain amount of process planning has been accomplished. However, with management's green light, the plant engineer should be prepared to step into an accelerated program.
2. Adequate staffing: It is obvious that any program will move only as fast as experienced personnel are placed upon it. This original staff will be an invaluable nucleus to be absorbed into the new operation.
3. Realistic scheduling: Any schedule must be flexible enough to cover unforeseen changes in processing, machine delivery and field conditions. However, it should also be firm enough to permit no excessive deviation therefrom.
4. Close coordination: All company activities involved in a launching program should virtually sleep in the same bed. With a lot of people affiliated there is of necessity a certain amount of confusion. However, this can be minimized by the continual exchange of information and the assurance that every one concerned has the latest thinking. Don't overlook the importance of staff meetings and conferences on a lower level.
5. Efficient reporting: Reporting serves two purposes: it keeps top management aware of program status and it highlights, to those most concerned, the areas to which special or immediate attention should be given.

Based on a paper presented at the Industrial Plant Maintenance Engineering Institute, University of Wisconsin, Madison, Wis.

BENCH MODEL II

this instrument will give you a decided edge in every competitive situation

NIKON OPTICAL COMPARATOR

for critical inspection and measurement of high-precision parts

A small investment, in one Nikon Optical Comparator, will spell enough economies to make a marked difference in your cost-competitive position. One, it will virtually eliminate the need for expensive mechanical gages. Two, it will release trained and skilled personnel for other critical work. And three, it will generally increase the efficiency, speed and accuracy of your quality control operation.

Inspection with the Nikon Optical Comparator is simply a matter of comparing the magnified image of the part under inspection with a master chart or a drawing affixed to the viewing screen. Precise measurements can be made of the most intricate contours—at a glance—by operators with comparatively little training. Further, accurate inspection of surface details and finishes can also be made. Thanks to Nikkor optics, the image is so bright and of such high resolution, that the entire inspection may be carried on in any normally well-lit room. And it can be viewed by several people at the same time.

So precise is the Nikon Comparator, that its use has enabled plants to enter into high-precision fabrication, and to achieve tolerances not available by any other methods. The Nikon Bench Model II can be easily carried from one part of the plant to another, for on the spot inspections and measurements, reducing "down time." Photo records of the image can be made in black and white or color.

It will pay you to investigate how a Nikon Optical Comparator can improve the cost-competitive picture of your organization. For complete details, write to: Nikon Incorporated, 251 Fourth Avenue, New York 10, N. Y. Dept. TE-8.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-156

ANOTHER CUSHMAN PINCH JAW CHUCK AT WORK!

Cushman has designed and engineered a complete line of both automatic and hand operated pinch type chucks featuring pinch units which exert gripping pressures of over 2,000 lbs at 85 p.s.i., with workpiece lift limited to less than .0002". While these chucks were primarily designed for precision machining jet engine discs and rings without distortion or strain, they are extremely adaptable and are equally suited to a range of products from rings of small cross section to large complicated weldments.

CUSHMAN CHUCKS,
a product of American quality, labor and materials.

Sold through your industrial distributor.

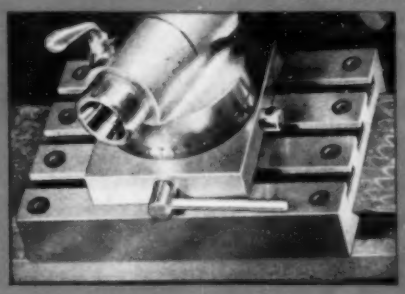
THE CUSHMAN CHUCK COMPANY

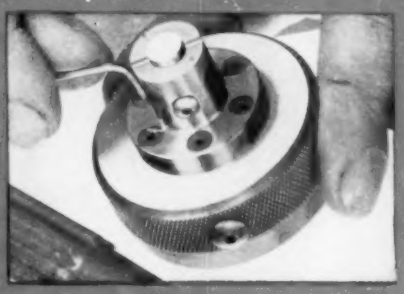
hartford 2, conn.

7CS58

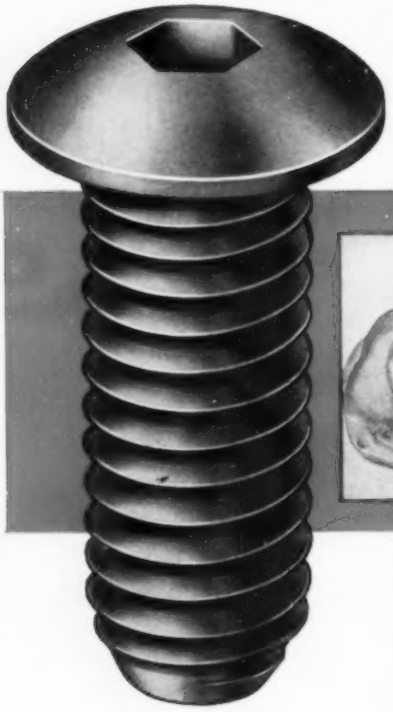
Use genuine Allen tough-gripping fastening for your flush and streamlined surfaces

Allen FLAT HEAD Cap Screws

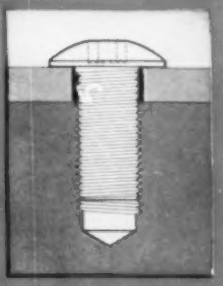




Allen Flat Head Cap Screws, in countersunk tapped holes, give you absolutely flush surfaces. Hex-socket wrenching entirely eliminates burred slots and protruding heads. Genuine Allen Flat Heads are "pressur-formd"—long fibers of the metal are preserved uncut throughout the whole length of the screw. Allen's exclusive Leader Point makes starting easier—prevents damage to lead thread. Class 3A fit; available in No. 4 through ¾" diameters. Write for FREE samples, dimensions, and full details.



Allen BUTTON HEAD Cap Screws



Where you can't countersink—fastening thin metal parts like covers, access panels or guards, for example—Allen Button Head Cap Screws will give you the smooth, streamlined effect you want. Hex-socket wrenching assures a tighter hold—eliminates driver slips, raised metal slivers, and skids that can damage and mar parts and finish. "Pressur-formd," like the Flat Heads above, for far greater strength at vital points. Leader Point. Class 3A fit. No. 4 through ⅝" diameters. Write for FREE samples and full information.

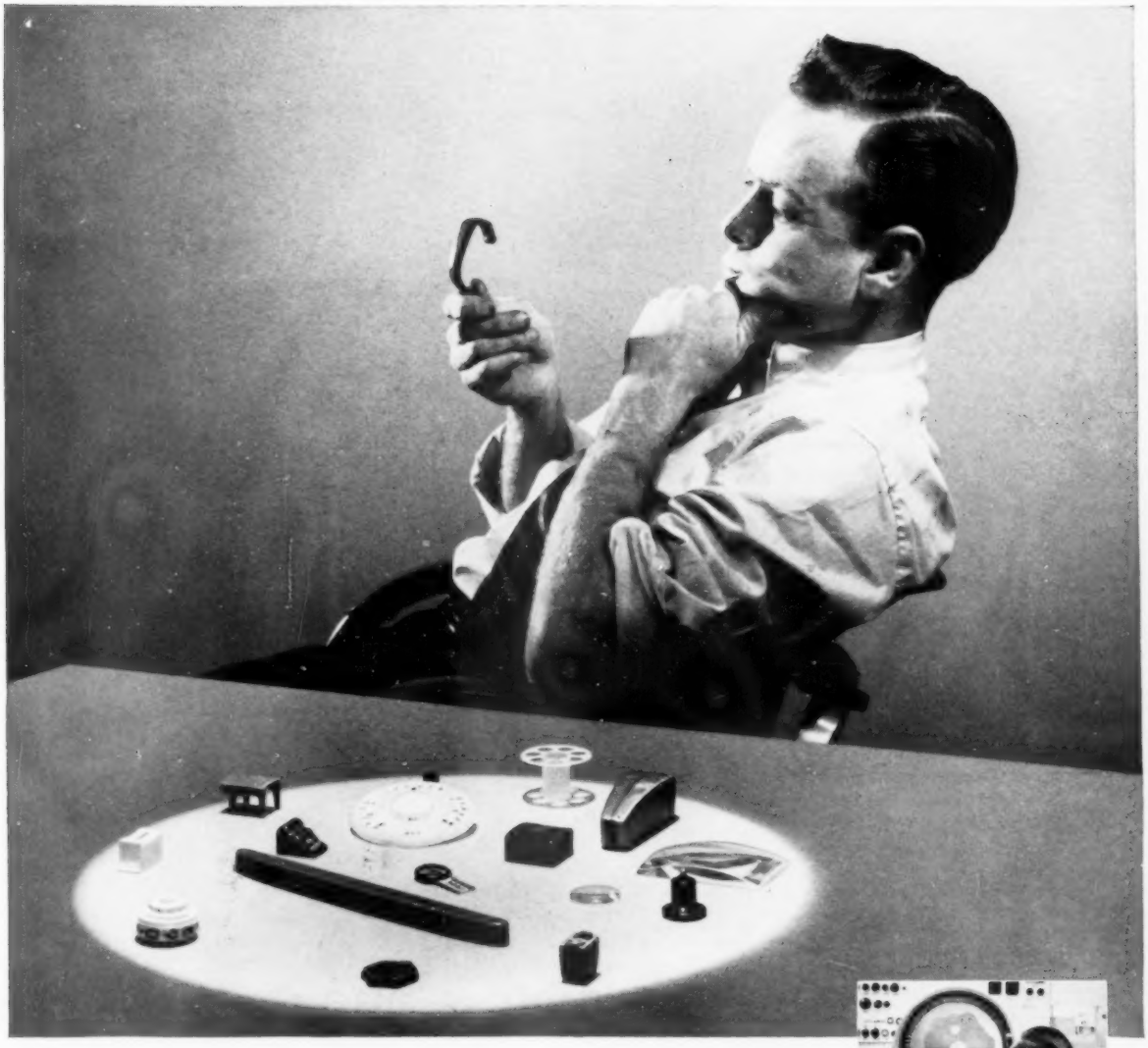
The cost of Allen Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost-saving advantages of *genuine* Allens.

ALLEN MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

Stocked and sold by leading industrial distributors everywhere

ALLEN HEX-SOCKET SCREWS HEAD

Ready in September . . . Allen's great new plant!



How many gages to inspect these parts?

Just one—if it's a Kodak Contour Projector.

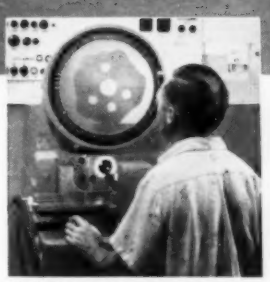
Auburn Plastics, Inc., of Auburn, N. Y., a venerable custom molder, produces a wide variety of component parts for various manufacturers. Formerly this firm needed many mechanical gages to make necessary quality control checks.

A *Kodak Contour Projector* eliminated the expense of buying such gages—amounting in *one instance to a saving* of *$5,000.*

In a fiercely competitive business, Auburn Plastics, Inc., can submit *lower* bids because of savings permitted by *optical gaging.* The company effects additional economies by using its Kodak Contour Projector to inspect *tools* and *dies* as well as manufactured components. In all cases the projector permits gaging of angles, radii, holes and other dimensions—at a glance.

If you have an inspection problem involving myriad small parts, you can do the job easily and inexpensively with a Kodak Contour Projector. Inspection is a matter of comparing the projected image of the part with a chart gage on the screen. You inspect different types of parts simply by changing chart gages. Operators need little training.

For additional information or to arrange for a demonstration of any of the 6 Kodak Contour Projector models, write to:



With this Kodak Contour Projector Auburn Plastics, Inc., accurately gages a great variety of parts down to .001". Operator can easily measure angular dimensions on cams and keys, threaded mold components, center-to-center dimensions on parts and tools.

Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

CONTROL is first! Now—one step static control with switching reactors

No wonder Nikita looks worried. CONTROL has taken the strain off American industry's pocketbook by cutting the cost of static control.

American engineers who want to make free use of power switching guided by digital logic can now take over, because CONTROL's standard line of switching reactors give freedom of design and economy never before available.

First, one-step static control with switching reactors is so easy to operate it can be put to work in everyday sequencing and switching problems involving either a-c or d-c loads. Auxiliary equipment is eliminated by the basketful. Gone are all the preamplifiers, special power supplies, information-sorting single purpose logic units, and power switching relays. CONTROL's one-step switching reactor does most of the job by itself.

Second, these units, in four nominal volt-ampere ratings of 15, 75, 150 and 300, have no relay contacts or moving parts to replace. Switching is by impedance change. Install them and forget them—no wear, no maintenance.

Third, each CONTROL reactor performs all logic functions —AND, OR, NOT, MEMORY and TIME DELAY—through its multi-purpose control coils. Signal source is derived typically from limit switches, push buttons, or photo-cells.

Fourth, each unit has a 10,000:1 switching ratio under nominal supply voltage conditions. High inrush currents are handled without difficulty.

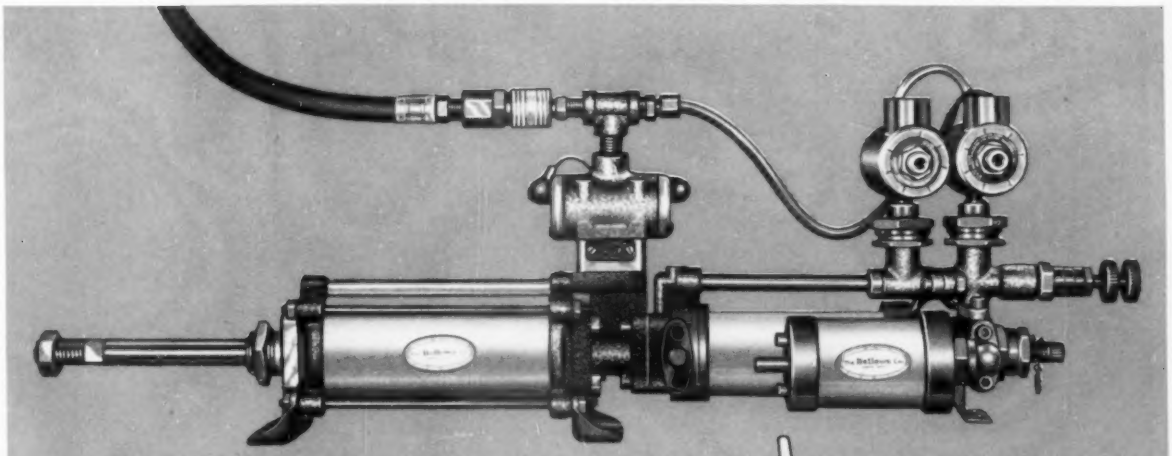
To learn how CONTROL reactors work, and how they'll fit your need for completely dependable, low-cost, versatile static control, write—and see why Nikita looks worried. *CONTROL, Dept.* **T-46**, *Butler, Pa. U. S. A.*

Reliability begins with CONTROL

A DIVISION OF MAGNETICS, INC.

*Expurgated translation. Heavens-to-Betsy!

HOW TO "INCH" AN AIR CYLINDER



With this packaged Bellows Air Motor-Hydro-Check Air Cylinder power unit you can do these things:

YOU CAN STOP THE PISTON ROD TRAVEL AT ANY POINT, OR AT AS MANY POINTS AS YOU WISH

YOU CAN "INCH" IT ALONG JUST AS WITH AN ELECTRIC DRIVE

YOU CAN CHANGE THE SPEED OF THE PISTON ROD TRAVEL FROM FAST TO SLOW AND BACK

You can set it up for single cycle control or synchronize it with related elements for repeat cycling with precision accuracy. This Bellows Air Motor-Hydro-Check unit is available in standard stroke lengths up to 18" and in five bore sizes: 1¼", 1¾", 2½", 3⅜", and 4½".

Not all pneumatic applications require the range of control provided in this Bellows unit, of course. But, regardless of the type of control you require, you can obtain it in Bellows Air Motors, and usually in the form of one compact, complete, packaged unit — simple to install — doubly simple to control.

THESE BULLETINS CONTAIN THE STORY

Bulletins BM-25 and HC-602 give full details on Bellows Air Motors and Hydro-Checks and the Bellows System of Air Control. There's no charge. Write Dept. TE-858, The Bellows Co., Akron 9, Ohio. In Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto 18, Ontario.

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

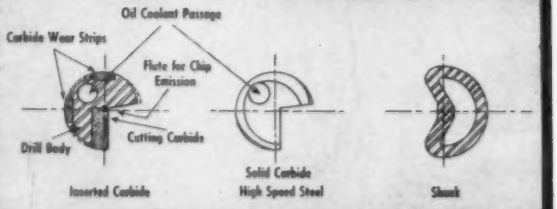
1125-B

THIS DRILL ELIMINATES SECONDARY OPERATIONS

Just *one* pass with these high-speed steel or carbide-tipped gun drills produces an accurate, truly round, straight hole honed to mirror-bright finish. That's why you can drill small parts of all kinds — *faster, more accurately* and at *lower cost* with HI-STANDARD Gun Drills*.

Production parts that once had to be drilled individually can now be gang-nested and drilled through, producing holes identical in size, location and finish. Drilling of this kind is done on automatic indexing machines, lathes, horizontal and upright drilling machines, and similar equipment. Forced oil feed through the drill clears chips and cools cutting edge for faster drilling. No matter what the size or shape of your workpiece, drilling with HI-STANDARD Gun Drills is an

DRILL TIP AND SHANK CROSS-SECTION



outstanding time-and-money saver. Any material that can be *machined*, can be *gun-drilled*.

Gun drilling is one important way in which forward-thinking manufacturers are increasing production and cutting costs. To find out how your company can do the same, write for your Hi-Standard Engineering File 20 *today!*

*Also called "deep-hole drills"

Pioneers in the Design and Development of Gun Drills for more than 30 Years

THE **HIGH STANDARD**
MANUFACTURING CORP.
HAMDEN • CONNECTICUT

USE READER SERVICE CARD; INDICATE A-8-162-1

ONLY

THRIFTMASTER *Universal Joint Type* **DRILL HEADS**

have these exclusive* features

6 Standard Models

Models U-608 and U-1000 —Ball Bearing

Models U-620B and U-1012B—Plain Bearing. 11/16" or 1/2" min. centers.

Models U-608-BS and U-1000—BS—Ball Bearing Gear Case. Plain Spindles.

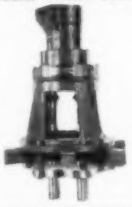
Semi-Standard Heavy Duty Full Ball Bearing

1/2" in Cast Iron— 7 1/8" or 9 3/4" Dia.
1/2 in Steel— 7" or 9 5/8" Dia.

Also larger Adaptations and Full Line of Fixed Center Drill Heads.

* Standard Full Ball Bearing Construction including Spindles.

Driving Assembly is FULL BALL BEARING mounted with 3 Bearings on each spindle. Thrust load carried by radial thrust bearings.



* Standard Slip-On and Slip-Off Template Construction.

For accurate setting and locating spindle brackets are machined to receive slip-on and slip-off template.

WRITE FOR FULL INFORMATION

THRIFTMASTER *Products Corporation*
A SUBSIDIARY OF THOMPSON INDUSTRIES, INC.

Also Makers of
DORMAN AUTOMATIC REVERSE TAPPERS

1014 N. PLUM STREET
LANCASTER, PENNA.

USE READER SERVICE CARD; INDICATE A-8-162-2

BEST IN QUALITY...BEST IN DESIGN!

Marcellus PRECISION BUILT TOOLING

ADAPTER BUSHINGS
Finest bushings available anywhere! Spring-type for fast set-ups. Prompt delivery from stock. *Quality guaranteed!*

RELEASING-TYPE TAP HOLDERS

BAR MACHINE TAP HOLDERS

SELF-ALIGNING REAMER HOLDERS

TURRET CHANGE ROLLS AND STUDS

ORIGINAL NON-RELEASING TAP HOLDER WITH HOLE THRU SHANK

REVOLVING STOPS

RECESSING TOOLS

CAM AND BOX MILL ROLLS AND PINS

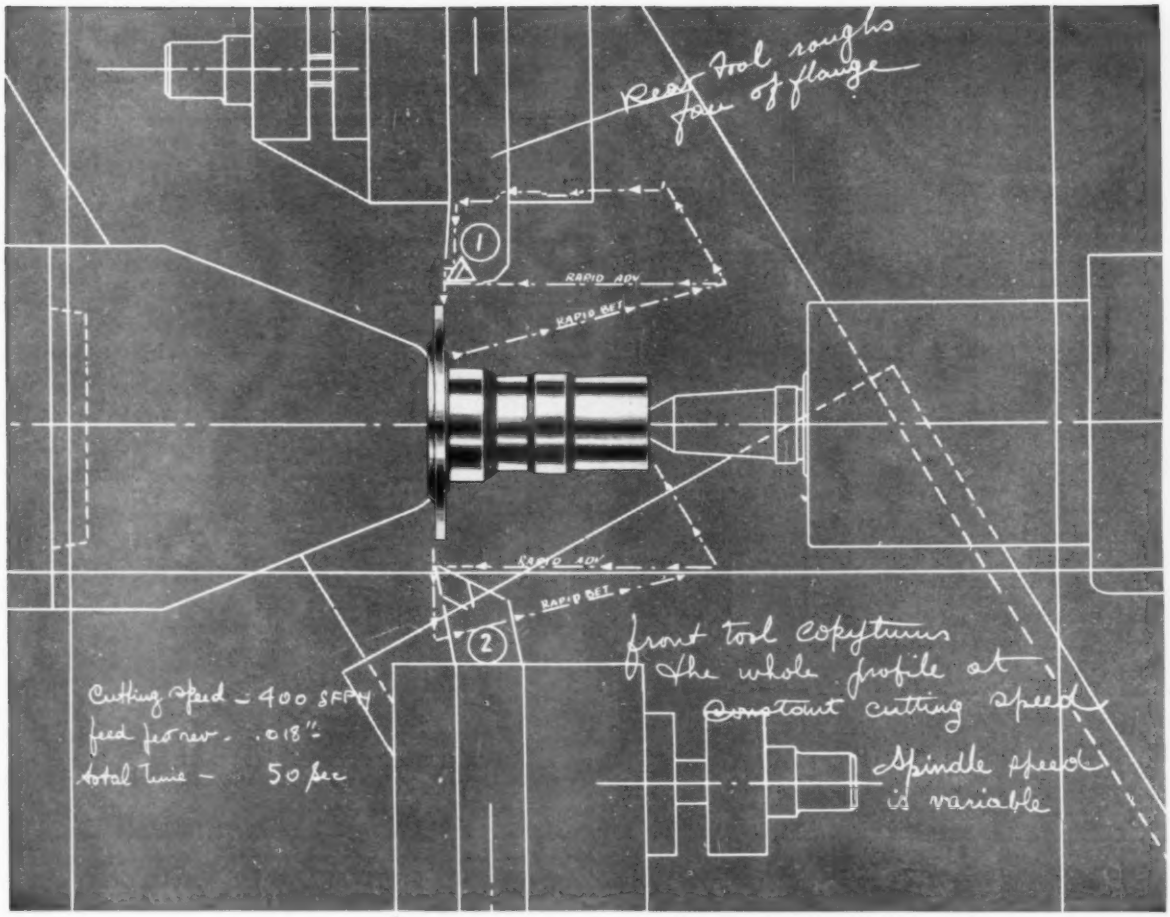
GAGES
ADAPTERS

NEW CATALOG... *FREE*

Get your copy NOW. Complete sizes and specifications for easier tool planning. WRITE TODAY. *Open territories available.*

Marcellus Mfg. Co. BELVIDERE ILLINOIS

USE READER SERVICE CARD; INDICATE A-8-162-3

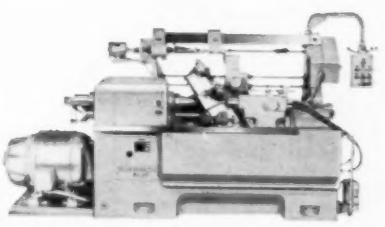

Rear tool roughs face of flange
RAPID ADV
RAPID RET
RAPID ADV
RAPID RET
Front tool copyturns the whole profile at constant cutting speed
Spindle speed is variable
Cutting speed = 400 SFPM
feed per rev. = .018"
total time = 50 sec

In 50 seconds

the Conomatic Pilot copyturns this entire profile at constant cutting speed

The Conomatic Pilot is the only multicycling copying lathe that provides constant feed per revolution by means of a piloted hydraulic feed—an important reason why you can profile turn parts like this to very close tolerances on all surfaces at full production speeds. When used for finishing only, the Conomatic Pilot can often eliminate green grinding operations.

Write today for details of the Conomatic Pilot lathe.



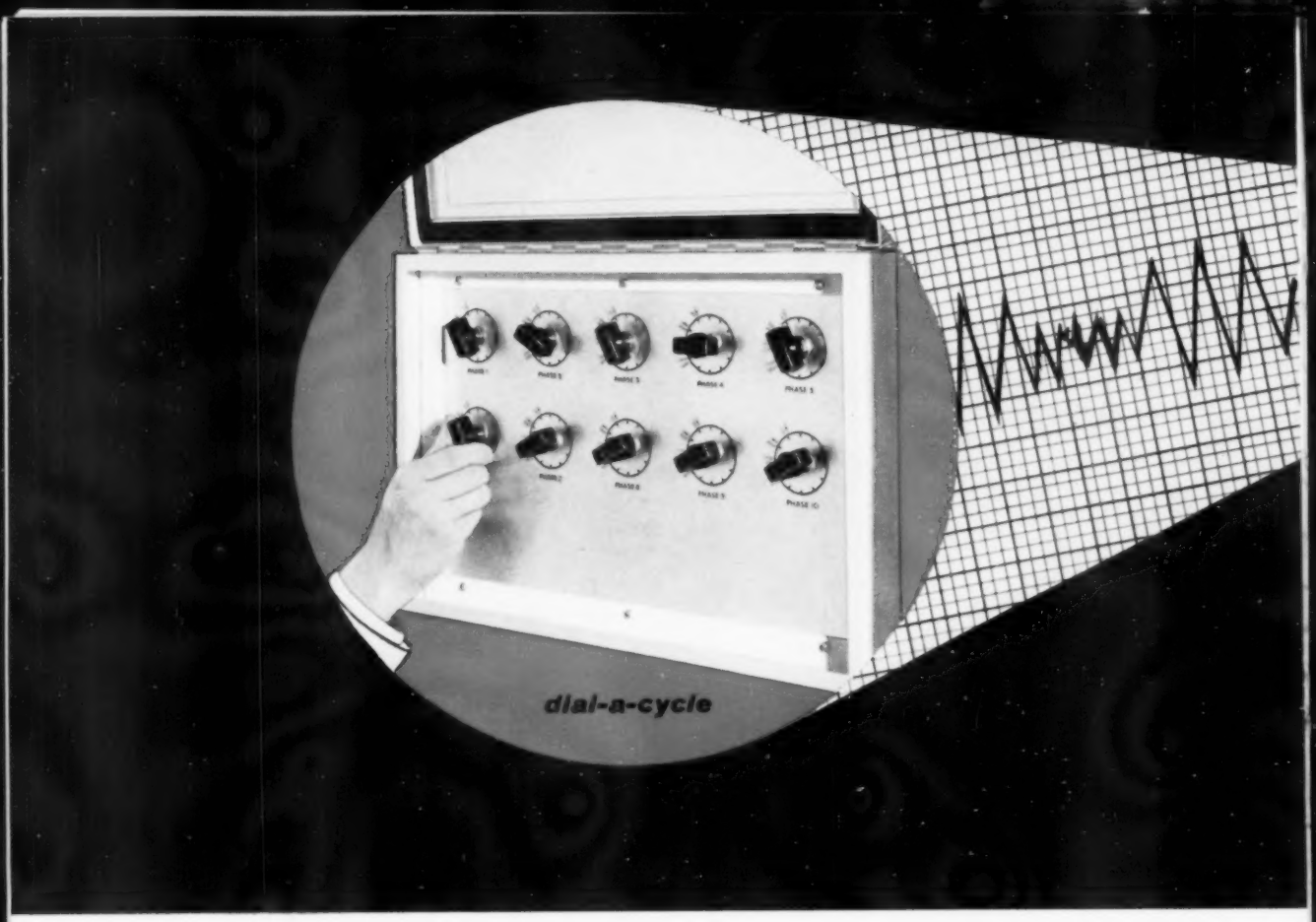
The Conomatic Pilot Model KU is a hydraulically-controlled multicycling copying lathe that can automatically reproduce practically any profile, using a motorized rotating template. It can be adapted to a wide variety of slides and tool stations.

Conomatic

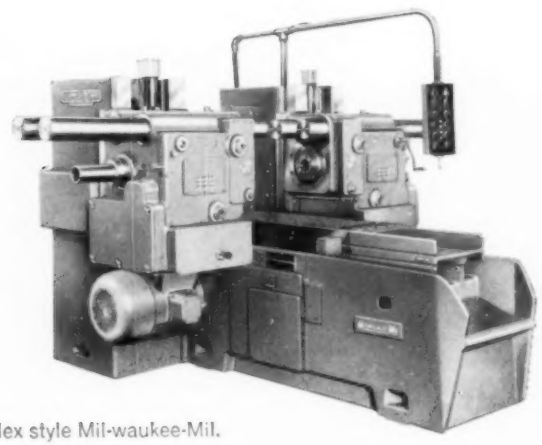
CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

30 Rockefeller Plaza, New York 20, N. Y.



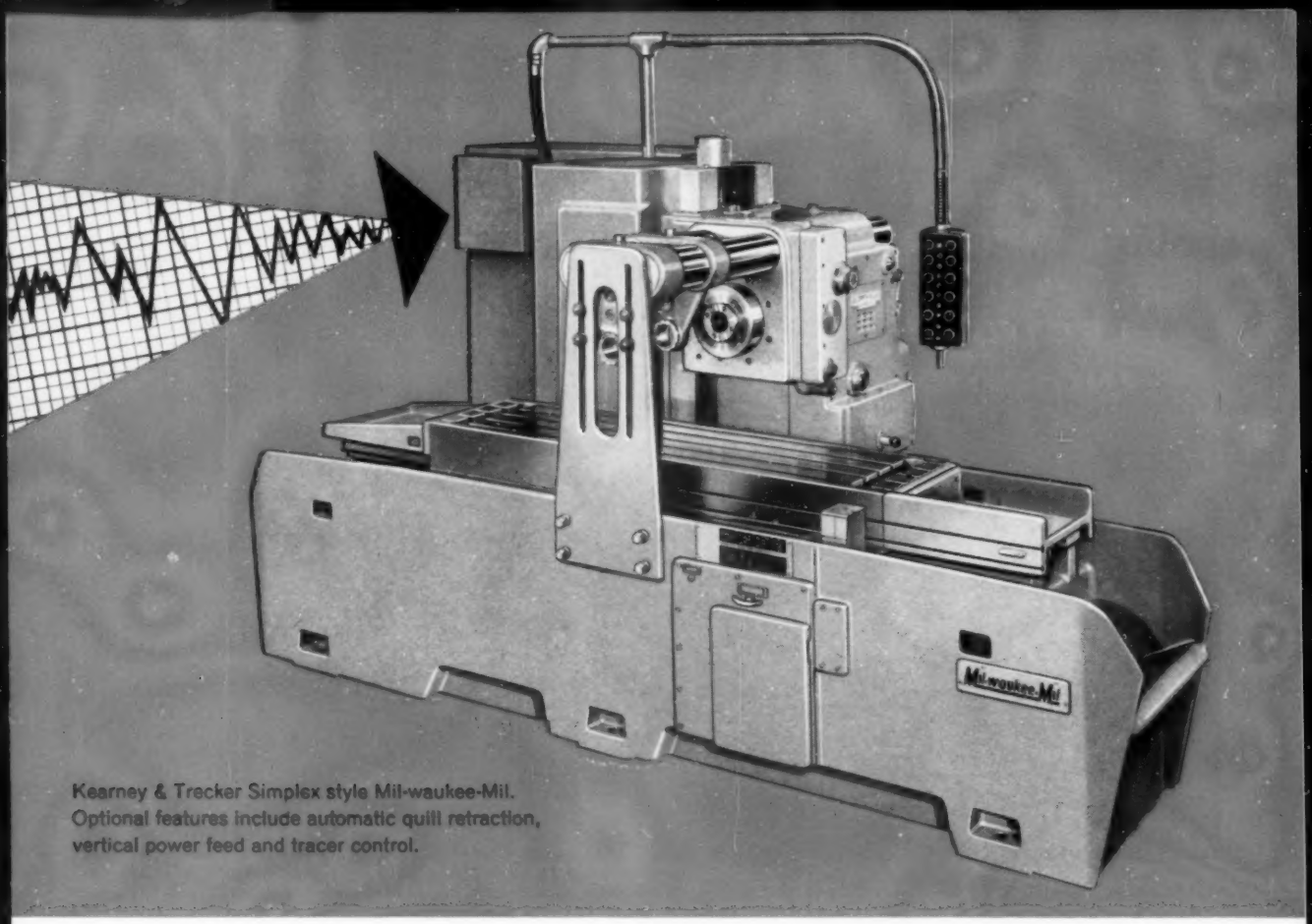
*first **dial** your results from the blueprint . . .*



Kearney & Trecker Duplex style Mil-waukee-Mil.

KEARNEY & TRECKER
MILWAUKEE
®

Designers and Builders of Precision and Production Machine Tools Since 1898



Kearney & Trecker Simplex style Mil-waukee-Mil. Optional features include automatic quill retraction, vertical power feed and tracer control.

then get programmed production ***automatically***

with the NEW ***Kearney & Trecker***

Mil-waukee-Mil® BED TYPE

PRODUCTION MILLING MACHINE

- ***dial-a-cycle*** **panel programs and controls each and every machine function . . . automatically!**
- **Interrupt or resume cycles at any time without returning to "start" position!**
- **Change from *dial-a-cycle* automatic control to manual with the flip of a switch!**
- **Choose from 72 standard models . . . Simplex and Duplex . . . 7½ to 30 hp.**

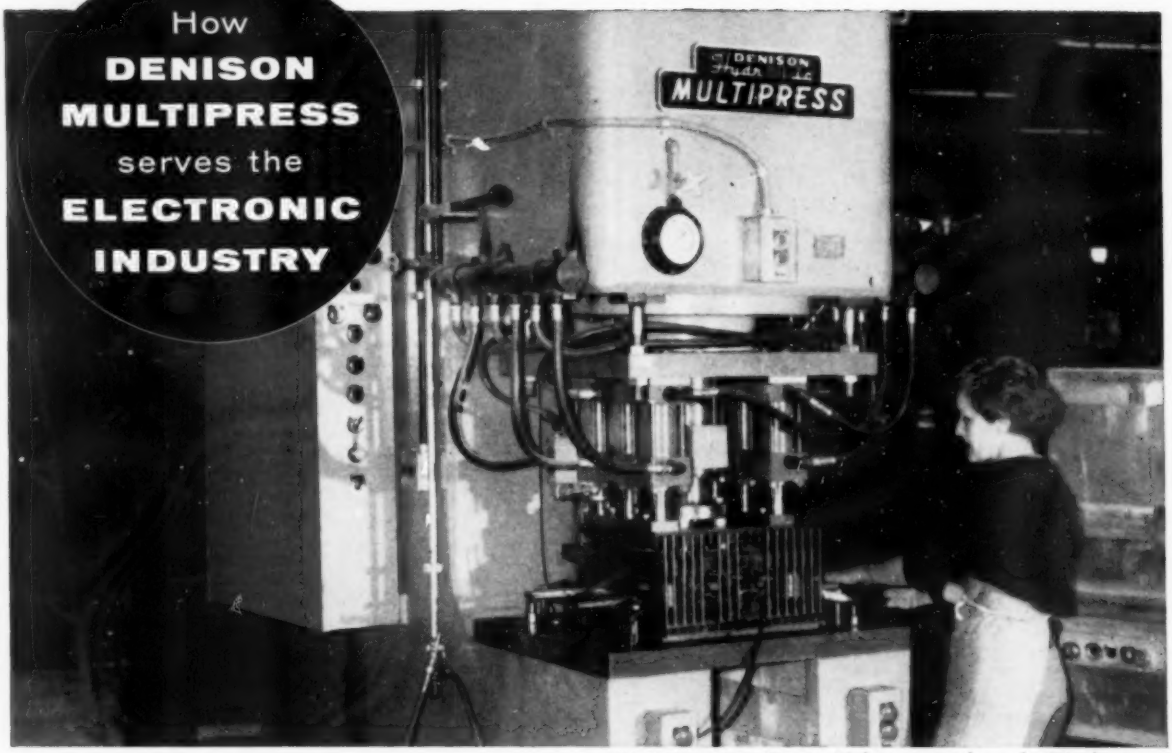
Fast, pre-phased setups slash idle cutter time — dramatically boost finished workpiece production. Do it on this remarkable new Kearney & Trecker Mil-waukee-Mil programmed production milling machine.

Operator simply dial-programs machine function into the ***dial-a-cycle*** control panel. No guesswork! He merely reads workpiece blueprint and establishes machining sequence with successive phase-switch dials.

Free Bulletin MM-58 —

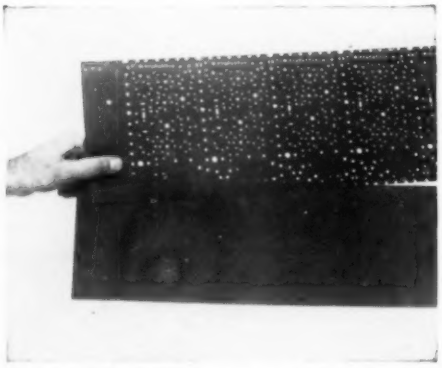
Kearney & Trecker Corp., 6772 West National Ave., Milwaukee 14, Wisconsin.

How **DENISON MULTIPRESS** serves the **ELECTRONIC INDUSTRY**



450 HOLES AT A TIME... *Multipress punches radio-TV chassis on this 100-ton Denison hydraulic Multipress at Motorola, Inc., Chicago.*

Precision-punching TV chassis holes faster—450 at a time—at **MOTOROLA** with **DENISON** hydraulic Multipress



RESULTS... *Motorola's plastic chassis bases are punched faster, to precise limits with Denison Multipress.*

At a Motorola plant in Chicago, plated-circuit chassis (designed as a base for radio and TV packaged electronic circuits) are precision-punched faster on a 100-ton Denison hydraulic Multipress.

With one quick, controlled ram stroke, Multipress *punches up to 450 holes at a time* in these plastic chassis boards. And Multipress does the job without shock to exact pre-set pressures... with absolute *control after breakthrough.*

Precision hydraulic control means Multipress *punches holes cleaner, smoother*... affording a uniform plating surface inside each hole. No bulging around holes... no cracking between holes... minimum breakout.

Plus benefits: die life is improved... there's almost no punch breakage... far less scrap loss compared to the former mechanical method which also had high shock and slow punching speed. With its *fast setup,* Multipress handles 15 different dies with *quick changeover* to other full-production jobs.

Endless jobs throughout the electronic and other industries can be done *faster... for less cost* with Denison hydraulic Multipress—from 1 to 100 tons. Ask your Denison production specialist to show you how.

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1182 Dublin Road • Columbus 16, Ohio

Denison, Denison HydrOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

ANNOUNCING

the cylinder you designed!

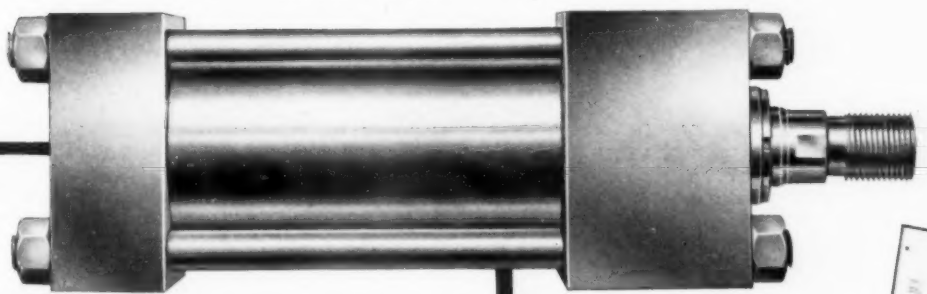
To save you and hundreds of other busy engineers time at the drawing board, Hanna representatives asked what you desired in hydraulic cylinder design.

You wanted a **stronger cylinder, preferably all steel with welded mountings.** You also wanted **tight sealing** at all pressures. These features were included in the Hanna Powrdraulic design. Some wanted **automotive piston rings;** others wanted **synthetic piston packings,** so the new flexible Powrdraulic design gives you a choice. You can also choose the **fast change cartridge gland** or the conventional **multiple lip packing** and you have a **choice of packing material** including Teflon* and silicone rubber.

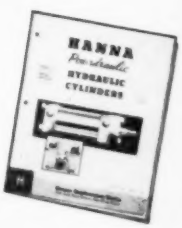
Hydraulic cylinders should incorporate **industry standard mounting dimensions** and conform to Joint Industry Conference recommendations. These are included in the Powrdraulic design.

In addition, you want a cylinder that is **priced right,** with **prompt delivery** and **service available** in all parts of the country. You can have all this plus the assurance of quality when you specify Hanna Powrdraulic cylinders.

We will be happy to send you a catalog, and give you the name of your nearest Hanna Representative. You'll also find him listed in the yellow pages under "Cylinders" and in the alphabetical section of Thomas' Register.



Hanna Powrdraulic Hydraulic Cylinder
2000 psi and 3000 psi non shock — with generous factor of safety
Featuring — Pressure tightening tube seals
• One piece steel heads with welded mountings
• Double seal piston rings • Fast change cartridge gland
• Lubricated rod bearing



For full details write for Catalog 900

* Teflon is DuPont's registered trademark for its fluorocarbon resins.

Hanna Engineering Works

HYDRAULIC & PNEUMATIC EQUIPMENT • CYLINDERS • VALVES

1765 ELSTON AVENUE • CHICAGO 22, ILLINOIS

C. T. WEITZEL, President, Mechanical Specialties Co.
5700 West 96th Street, Los Angeles, California

a man who came to Fair Street

"We were skeptical of the claims for the JIGMIL Technique until we came to Fair Street. There we found the machine that met our need for accuracy and versatility with features to spare.

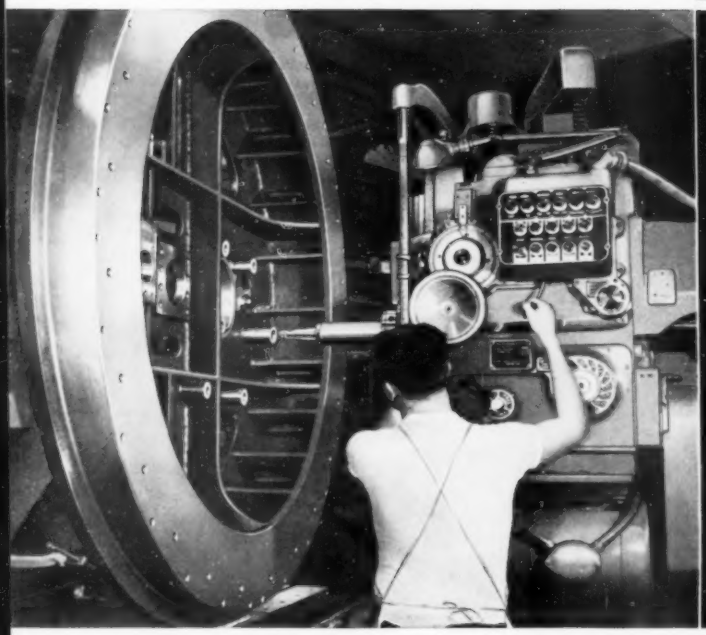
"As a contract manufacturer of tools, dies and precision components, we long felt the need for something new in the way of a precision boring and milling machine. Among other things, we wanted a machine having a configuration which would permit easy set-ups of a wide range of awkward and bulky work pieces. In 1946, we heard about the JIGMIL and the JIGMIL Technique of jigless boring. The claims for this machine were so unusual that we discounted much of what we heard, but decided that we should at least look into it. At Fair Street, we found the machine that met all our requirements with features to spare. Our first JIGMIL put us in a position to handle an entirely different class of work and without doubt, aided materially in our subsequent growth and development. Today, we have four JIGMILS which are consistently busy and consider them ideal job shop machines."

C. T. WEITZEL

DE VLIEG MACHINE COMPANY, 450 FAIR STREET

SOME OF OUR JIGMIL USERS

Airesearch Mfg. Co., Div. The Garrett Corp.
Bell & Gossett Co.
The Brush Beryllium Co.
H. W. Butterworth & Sons Co.
Byron Jackson Pumps, Inc.,
a Subsidiary of Borg-Warner Corp.
Cameron Iron Works, Inc.
The Cleveland Pneumatic Tool Co.
Delco-Remy Div. General Motors Corp.
Eastern Air Lines, Inc.
Euclid Div. GMC
Fairchild Camera and Instrument Corporation
General Atomic Div. General Dynamics Corp.
Goodyear Aircraft Corp.
C. L. Gougler Machine Co.
Greenlee Bros. Co.
Hoover Tool & Die Co.
Hughes Aircraft Co.
The Hydraulic Press Mfg. Co.
I-T-E Circuit Breaker Co.
Kaiser Industries Corp.
Koppers Co., Inc.
Kurt Mfg. Co.
Librascope Incorporated
Lycoming—Div. of Avco Manufacturing Corporation
Manning, Maxwell & Moore, Inc.
Massachusetts Institute of Technology
Maytag Co.
Menasco Mfg. Co.
McKiernan-Terry Corporation
National Cash Register Co.
Norden-Ketay Corp.
Robbins & Meyers, Inc.
Rocketdyne Div., North American Aviation, Inc.
Rohr Aircraft Corp.
AC Spark Plug Division, General Motors Corp.
Sperry Farragut Co., Division of Sperry Rand Corp.
Stratos Div. Fairchild Engine & Airplane Corp.
Sundstrand Machine Tool Co. (Aviation Div.)
Sylvania Electric Products, Inc.
Utica-Bend Corp., a Subsidiary of
Curtiss-Wright Corporation



A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

ACCURACY IS AN ECONOMY!

A TYPICAL EXAMPLE OF JIGMIL PRECISION
applied to the guided missile program

Mechanical Specialties Co. uses the JIGMIL Technique for machining pieces such as this 3500 lb. traversing-launching ring for guided missiles. Part is set-up on a Model 3B-96 JIGMIL. Critical machining involves boring 24 indexing holes on a 60" dia. with hole spacing of ± .0005; an interior hole pattern of 5 holes coordinated to a master within ± .00025; 30 additional holes in a 30" x 36" rectangular pattern to ± .001; accurate milling of locating pads and boring of 3 large critical bores to ± .001.

WILL YOU BE THE NEXT TO VISIT FAIR STREET

Our newest catalog will help you decide. May we send it?

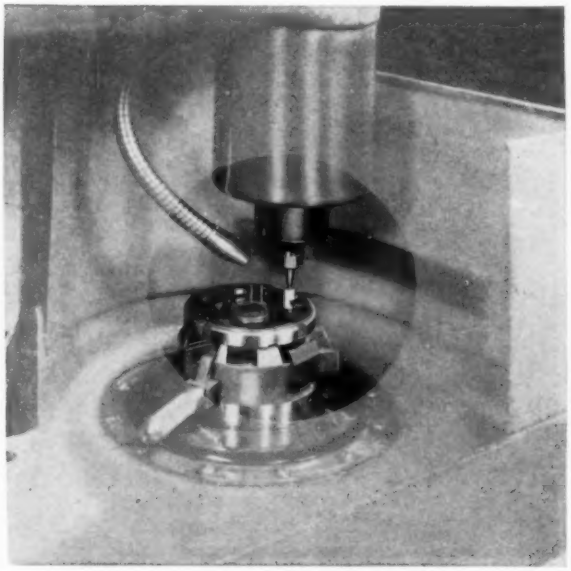
DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

FERNDALE • DETROIT 20

HOLES JIG GROUND with *Vulcanaire*



VULCANAIRE AIR MOTOR ON PRODUCTION

Production cams with eight slots to be ground to tenths of thousandths. A special machine was used for indexing and oscillating. The Vulcanaire holds up under severe production schedules. Production ground parts to close tolerances! Another satisfied customer.

Provide yourself with this inexpensive instrument for use on your present equipment and JIG GRIND with a guarantee.

{ Borrow our instructive 11 minute movie on Jig Grinding. }

SERVICES OF YOUR TOOL ROOM IN DAYTON
ENGINEERING • PROCESSING • BUILDING • TOOLS
DIES • SPECIAL MACHINES • VULCANAIRE JIG
GRINDERS • MOTORIZED ROTARY TABLES • BREHM
"SHIMMY" AND RELATED DIES • AUTOMATION

Vulcan's 41st Year

VULCAN TOOL COMPANY
751 Lorain Ave., Dayton 10, Ohio

VULCAN tools

USE READER SERVICE CARD; INDICATE A-8-170-1

ACCURACY .0002 T.I.R.

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

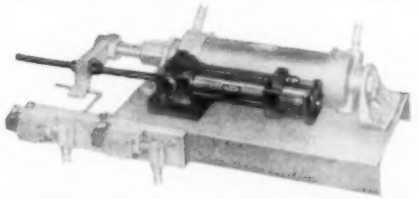
No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

USE READER SERVICE CARD; INDICATE A-8-170-2

VERI-TROL HYDRAULIC CHECKING CYLINDERS



—designed for use with air cylinders to smooth out stroke variations due to compressibility of air under irregular load conditions.

- ACCURATE SPEED CONTROL is dial-set, load-compensated to assure uniform stroke speed even with irregular loads.
- VISIBLE OIL RESERVOIR, easy to refill.
- 2,000 LB. CHECKING CAPACITY on out stroke, free return.
- 2", 4", 6", 9", 12", 15" and 18" checking stroke lengths.
- IDEAL FOR LOW-COST TOOL OR WORK-PIECE FEEDS.

Take the bumps and jumps out of air cylinder operation — install VERI-TROL checking cylinders wherever you want smooth, accurately-controlled stroke speed. Write now for free data bulletin.

Modernair CORPORATION

Dept. H-8 400 PREDA STREET, SAN LEANDRO, CALIF.

Member National Fluid Power Association 34

USE READER SERVICE CARD; INDICATE A-8-170-3

SURFACE TREATMENT #2

Flash Chrome Plating For Increased Productivity

Recently developed electro-chemical techniques perfected by Bay State make possible the application of a very thin deposit of chromium on the surface of a conventionally heat treated high speed tap.

Flash chrome plated taps provide greatly increased productivity, particularly in the tapping of copper, brass, zinc base die castings and cold forming steels. This is another important factor contributing to the PRECISION PERFORMANCE records so well known to users of Bay State Taps.

Order Bay State . . . and Requisition a Record!

BAY STATE TAPS

Bay State Tap & Die Company • Mansfield, Massachusetts

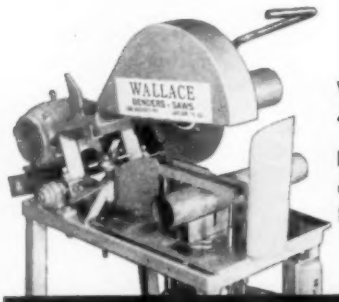
On the nearby shelves of your Industrial Supply Distributor

You can get these same high quality cut ends. And in just seconds each! Nothing cuts as fast, nothing cuts as clean as Wallace Cut-Machining.

The WALLACE Modular

3 sizes . . . 16" — 18" — 20" . . . cut to 6" O.D. capacity.

Also machines for plate or pipe to 30" and *specials*.



WRITE for free 44-page book.

Phone COLLECT for quick information: BUckingham 1-7000

Answers to Hundreds of Bending or Cutting Problems

As shop operators or engineers, you can solve problems quickly with "A MANUAL OF PROCESSES for the Cold Bending of Metals and Abrasive Cut-Machining of Metals."
200 pages, 148 pictures.

You'll find clear, concise answers to: Why bends wrinkle? Why some bends break? What makes burrs in abrasive cutting? Why abrasive wheels break at times? Which wheel is the right wheel? How fast can steel be cut? And hundreds of other shop questions.

Don't be a "head scratcher." Have the answers at your fingertips.

Only $3.00 (plus 30c postage).
You save postage by sending cash with order.

ORDER SEVERAL TODAY
BEST INVESTMENT YOU CAN MAKE

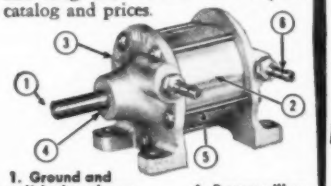
WALLACE SUPPLIES MFG. CO.

1304 W. Wolfram Street • Chicago 13, Illinois
USE READER SERVICE CARD; INDICATE A-8-172-1

AIR-MITE AIR CYLINDERS

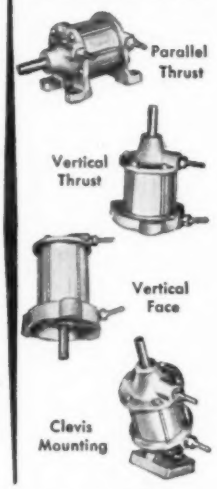
Low Cost . . . Compact . . . Powerful . . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE

4407A W. KINZIE • CHICAGO 24, ILLINOIS

USE READER SERVICE CARD; INDICATE A-8-172-2

new ELASTICONE® guide pin covers CUT DIE COSTS 25%

reduce lubrication
reduce maintenance
increase press time
preserve alignment

Discover how inexpensive ELASTICONES can provide increased production, lower die costs by closing the gaps between pins and bushings, reducing die breakage and maintenance. Just snaps into place — no installation or maintenance costs! Bulletin 53 contains complete information. Send for it today!

CENTRAL Safety Equipment Co.

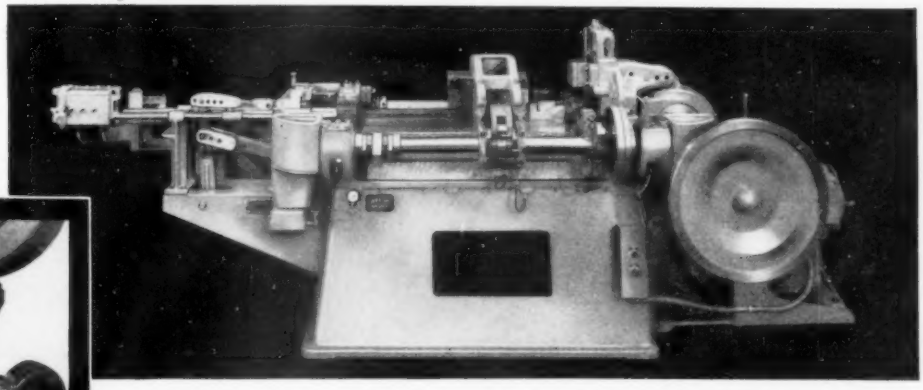
6815 MARSDEN ST. PHILADELPHIA 35, PA.

Use coupon for new Bulletin '57 and Data Sheet '58.

Name_____ Title_____
Firm Name_____
Address_____
City_____ Zone____ State_____
TE-858

USE READER SERVICE CARD; INDICATE A-8-172-3

MULTI-SLIDE® MACHINES
/ Reduce Pressroom Costs



Model #35 U. S. Multi-Slide Machine in which 4 die heads (rams) can be used simultaneously.

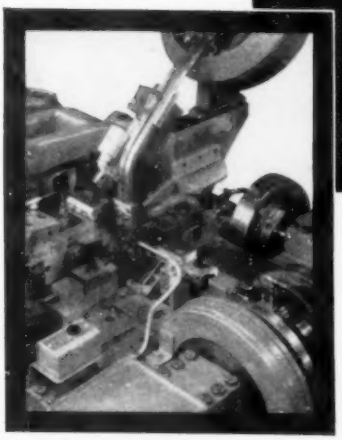


FIGURE 1A

The versatility of the U. S. Multi-Slide for the production of stampings, or assemblies which include stampings, enables you to reduce price part costs by eliminating expensive secondary operations.

The various movements obtainable with the standard machine equipment allow for automatic production of intricately formed stampings—complete in one operation. Then, a variety of auxiliary attachments, available for use in conjunction with the standard movements, make it possible to go further and fabricate many different types of assemblies—**in the machine —a completed assembly at each cycle.**

Ask for a copy of Bulletin #15 (T) or, to compare manufacturing costs send in samples or drawings of the part you want to produce.

FIGURE 1

FIGURE 1. Sequence followed in producing cage and nut assembly on #33 U. S. Multi-Slide. Cage made in machine from flat stock which comes in coils. Prefabricated nut hopper fed—(Figure 1A) into position and clinched to complete the assembly.

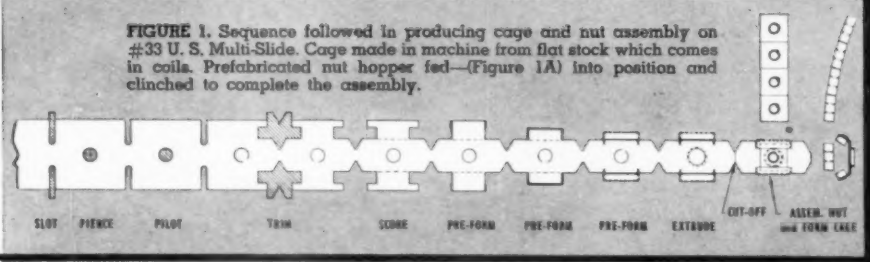


FIGURE 2

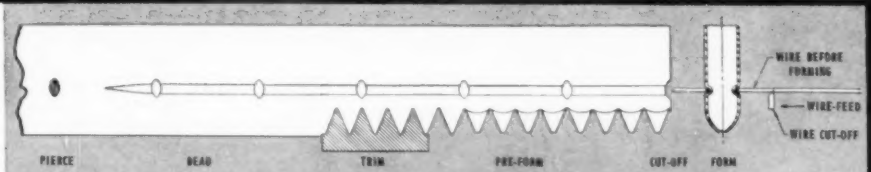


FIGURE 2. Tube reinforcement consists of a flat stock stamping and a wire part—both produced and assembled in a #35 U. S. Multi-Slide. Flat stock progressed from left to right and wire from right to left as indicated. Assembly completed in final forming position.

PRODUCTS

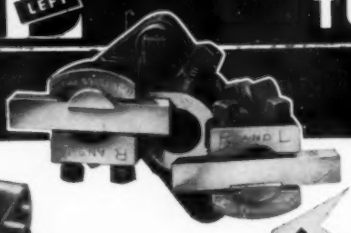
U. S. TOOL COMPANY, INC.

AMPERE *(EAST ORANGE)* NEW JERSEY

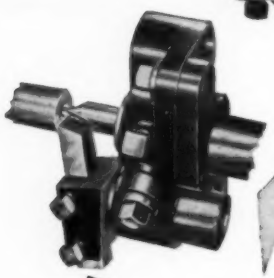
U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

R and L TURNING TOOL

REPLACES AN ASSORTMENT OF 14 TOOLS!



The R and L Turning Tool can be changed from right to left in 10 seconds, and vice versa . . . It is guaranteed not to bend or give way in any manner.

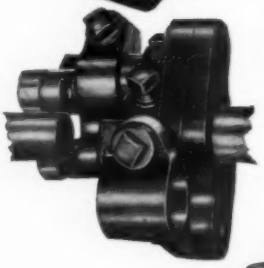


R and L Turning Tool used as BALANCING TURNING TOOL

R and L Turning Tool used as CENTERING & FACING TOOL

R and L Turning Tool used as KNEE TOOL

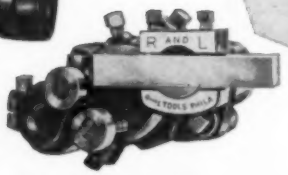
R and L Turning Tool used as BACK REST

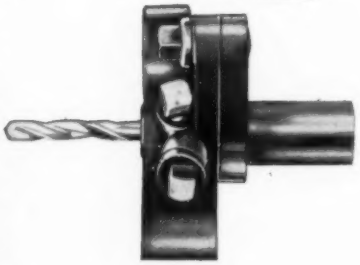


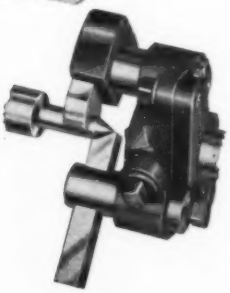
R and L Turning Tool used as ROLLER BOX TOOL

R and L Turning Tool used as FLOATING DRILL HOLDER

R and L Turning Tool used as POINTING TOOL







YOU SAVE ON YOUR ORIGINAL INVESTMENT

Roller Box Tool	$77.00
Centering and Facing Tool	22.00
Knee Tool	37.00
Pointing Tool	36.00
Back Rest	29.00
Floating Drill Holder	14.00
Balancing Turning Tool	52.00
	$267.00
Same for left hand	$267.00
	$534.00

One R and L TURNING TOOL of a similar size (No. 1) costing only $96.50 will take the place of the above assortment of tools!

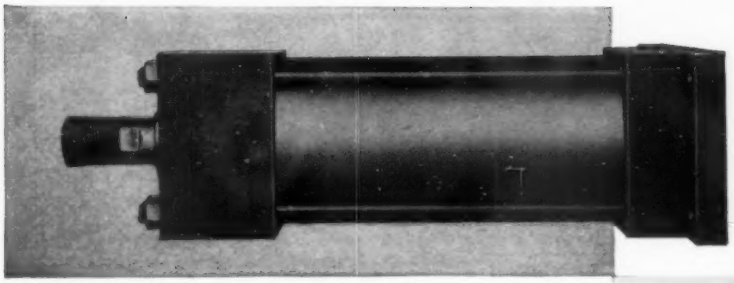
Write for NEW catalog

OTHER FAMOUS R and L TOOLS:

TURNING TOOL • COMBINATION SWING TOOL • CARBIDE OR ROLLER BACKRESTS RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

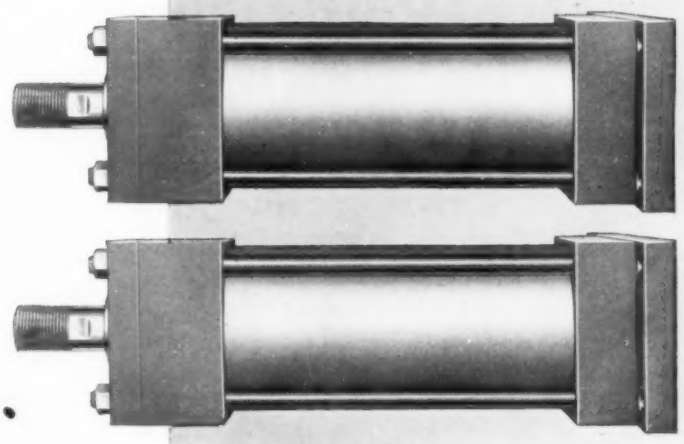
R and L TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.



◀ A LOGANSQUARE CYLINDER
2 competitors' cylinders
▼

do they LOOK ALIKE? ...sure they do on the surface...



...BUT LOOK AT Logan's BIG EXTRA PLUS VALUES

Logansquare Cylinders

are made to interchange with other leading manufacturers' cylinders . . .

1. Logan designs assure the service required for those extra-rugged applications.
2. Over FORTY YEARS of cylinder manufacturing know-how.
3. Built by CRAFTSMEN whose average service record with LOGAN is more than 20 years.
4. Manufactured in a plant which applies the most modern production methods.

FREE

SEND FOR THE "LOGAN CALCULATOR"

MEMBER: Natl. Mach. Tool Builders' Assn., Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
839 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-6 ULTRAMATION CYLINDERS
- ☐ 300-2 PRESSES
- ☐ FACTS OF LIFE
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 AND 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 300-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

EXTRA DRILLING CAPACITY FOR YOUR TOOLROOM

LELAND-GIFFORD NO. 3 MVB TOOLROOM DRILL PRESS

A companion machine to the widely used Leland-Gifford No. 2 LMS Toolroom Drill Press — providing extra capacity with comparable features and conveniences. This machine is always available to help with heavy-duty production work while handling the general run of toolroom drilling and tapping with effortless speed and ease.

✓ *check these features*

- √ Speeds from 33 to 1,800 RPM.
- √ Capacity of No. 3 Morse Taper.
- √ Extra large 40½" x 23½" or standard 24½" x 23½" tee-slotted table.
- √ 24" swing with 12" overhang. Geared power feed with feed rates of .006" — .012" — .018" per revolution.
- √ Illuminated indicating shift with cutting speed chart.
- √ Conveniently located hand wheel for changing spindle speeds and shifting back gears without stopping machine.
- √ Positive stop for accurate depth adjustment.
- √ Foot switch start-stop motor control.
- √ Counterbalanced sliding head.
- √ Built-in light for table and work illumination.

Write for complete information.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U. S. A.

Branch Offices:

CHICAGO 5
2515 W. Peterson Ave.

CLEVELAND 22
P. O. Box 853

DETROIT 21
10429 W. McNichols Rd.

INDIANAPOLIS 6
P. O. Box 1051

LOS ANGELES
2620 Leonis Blvd., Vernon 58, Cal.

NEW YORK
75 S. Orange Ave., South Orange, N. J.

ROCHESTER 12
P. O. Box 24, Charlotte Station

NEW all-welded box frame construction

NEW heavier, more rigid tool guide post

NEW automatic tool welder

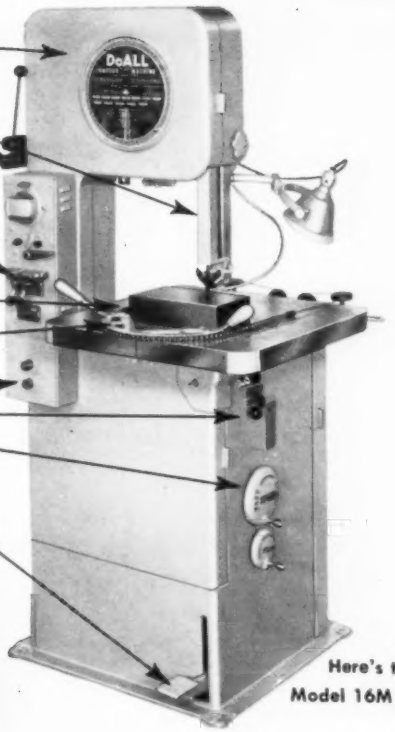
NEW heavy-duty drive—wide, stepless speed range

NEW precision-ground, non-glare, tilting table

NEW "job-tested" attachments

NEW easy-to-reach controls

NEW smooth, positive feed control



Here's the Model 16M (16")

NOW READY
2 new models

For Less Than $1000

You Can Own a Genuine DoALL Contour Machine

Now, at substantially lower prices, DoALL offers two new band machines—with the quality features and performance that defy competition. They have 16″ and 30″ throat and 12″ thickness capacity.

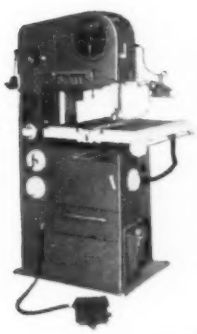
They're true multi-purpose machines—ideal for toolrooms, jobbing shops, sheet metal and maintenance shops. These new machines bring you the rigidity, power and operating ease that make DoALL the leader in the field.

With the Models 16M and 30M you are ready to handle a variety of assignments. In addition to sawing, the machines provide band filing, polishing, and friction cutting.

Entirely new, inside and out, these are modern, efficient, universal band machines. Variable-speed drive delivers smooth power for contour sawing of any machinable material. And accuracy is assured under even the heaviest cuts.

Let these new DoALL models help you beat rising costs. Ask for a free demonstration. Phone your local DoALL store. Or write for Bulletin 58-34.

B-52



For high production DoALL offers its Contour-matics® teamed with Demon® HSS saw blades

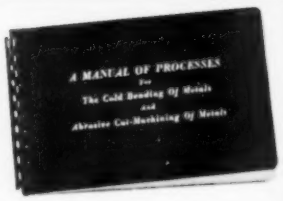
THIS IS A TYPICAL DoALL STORE

DoALL The DoALL Company
Des Plaines, Illinois

Call Your DoALL Service-Store

MACHINE TOOLS ..... CUTTING TOOLS ..... MEASURING INSTRUMENTS ..... SHOP SUPPLIES IN STOCK

Answers to Hundreds of Bending or Cutting Problems



You can solve problems quickly with "A MANUAL OF PROCESSES for the Cold Bending of Metals and Abrasive Cut-Machining of Metals." 200 pages, 148 pictures.

You'll find clear, concise answers to: Why do bends wrinkle? Why do some bends break? What makes burrs in abrasive cutting? Why do abrasive wheels break at times? Which wheel is the right wheel? How fast can steel be cut? And hundreds of other shop questions.

Don't be a "head scratcher." Have the answers at your fingertips.

Only $3.00 (plus 30c postage).
You save postage by sending cash with order.
ORDER YOURS TODAY!

WALLACE SUPPLIES MFG. CO.
1304 W. Wolfram Chicago 13, Illinois
USE READER SERVICE CARD; INDICATE A-8-178-1

PRECISION CUTTERS!

MADE TO YOUR EXACT SPECS... SOLID CARBIDE, OR CARBIDE TIPPED!

Why put up with stock cutters, when made-to-order cutters cost no more? Cutters designed for specific gang-milling, slotting, venting, slitting or grooving operations in various diameters and thickness to suit YOUR needs exactly. Fast service: all component materials carried in stock. Top-flight reputation for dependability built since 1888. Furnish complete specs, quantities desired and material to be cut when requesting prices. Write for Bulletin No. 52

W. F. MEYERS CO., INC., BEDFORD, INDIANA
USE READER SERVICE CARD; INDICATE A-8-178-3

NEW RAVA ELECTRO-DYNAMIC BALANCING MACHINES

Accurate . . . sensitive . . . easy to operate . . . easy to setup—Rava answers the need for efficient, low cost static-dynamic balancing machines for production and small or mixed lots. Available from Tinius Olsen in capacities from a few ounces to a ton or more.

Write today for Bulletin 56.

Trademark Reg. U.S. Pat. Off.

TINIUS OLSEN
Testing Machine Co.
2110 Easton Rd. • Willow Grove, Pa.

USE READER SERVICE CARD; INDICATE A-8-178-2

More than 20,000 Plant Operating Executives are expected to attend the

ASTE WESTERN TOOL SHOW
SEPTEMBER 29 - OCTOBER 3
LOS ANGELES, CALIFORNIA

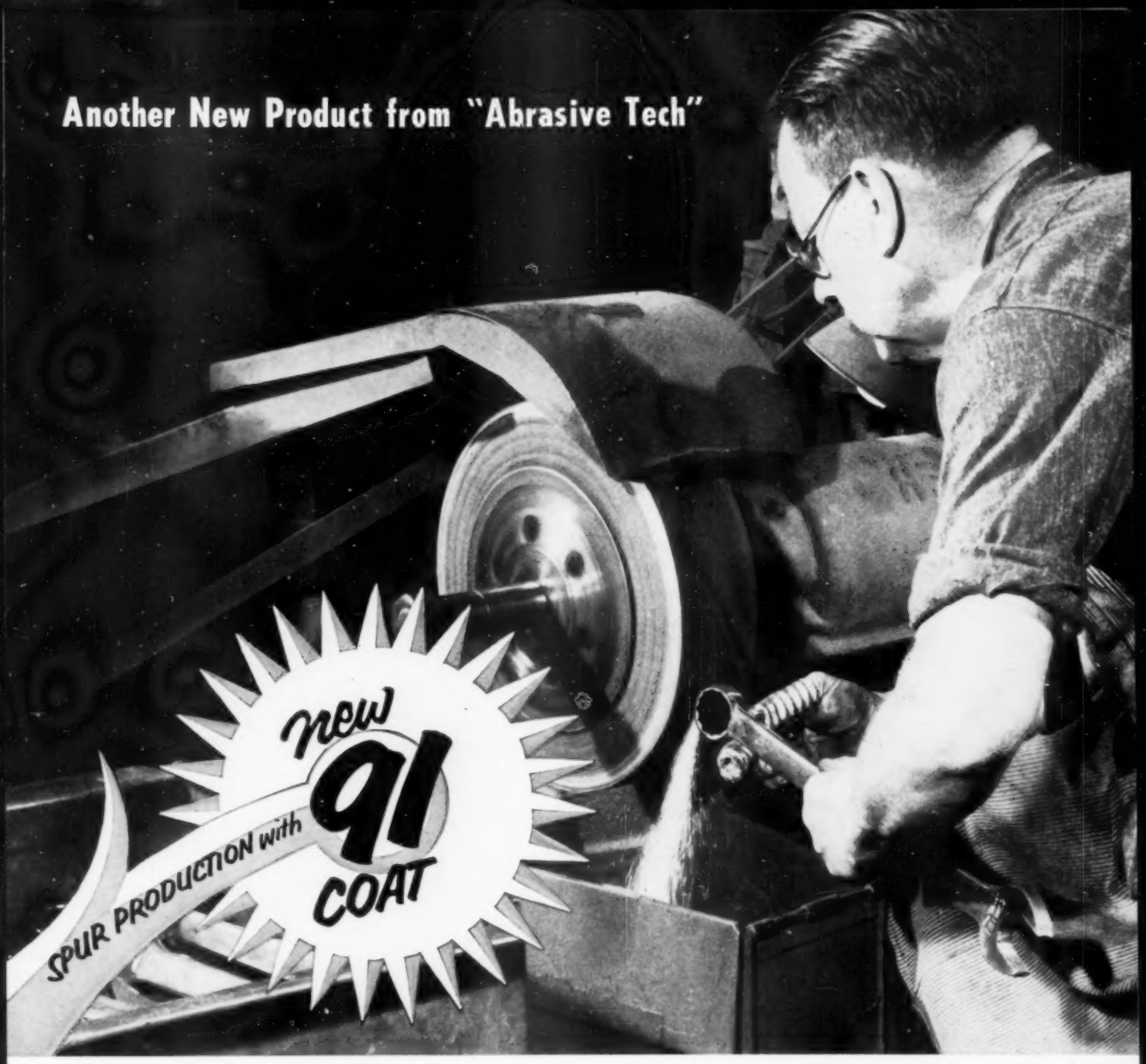
WILL THEY SEE *YOUR* EXHIBIT?

For information on exhibit space, phone or write:

Exposition Committee
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan
UNiversity 4-7300

TE-1

Another New Product from "Abrasive Tech"



Fast work . . . roughing the box ends of 1½" combination wrenches with 50-X RESINALL METALITE "91" Coat Cloth Belt.

Cuts "roughing" time in half!

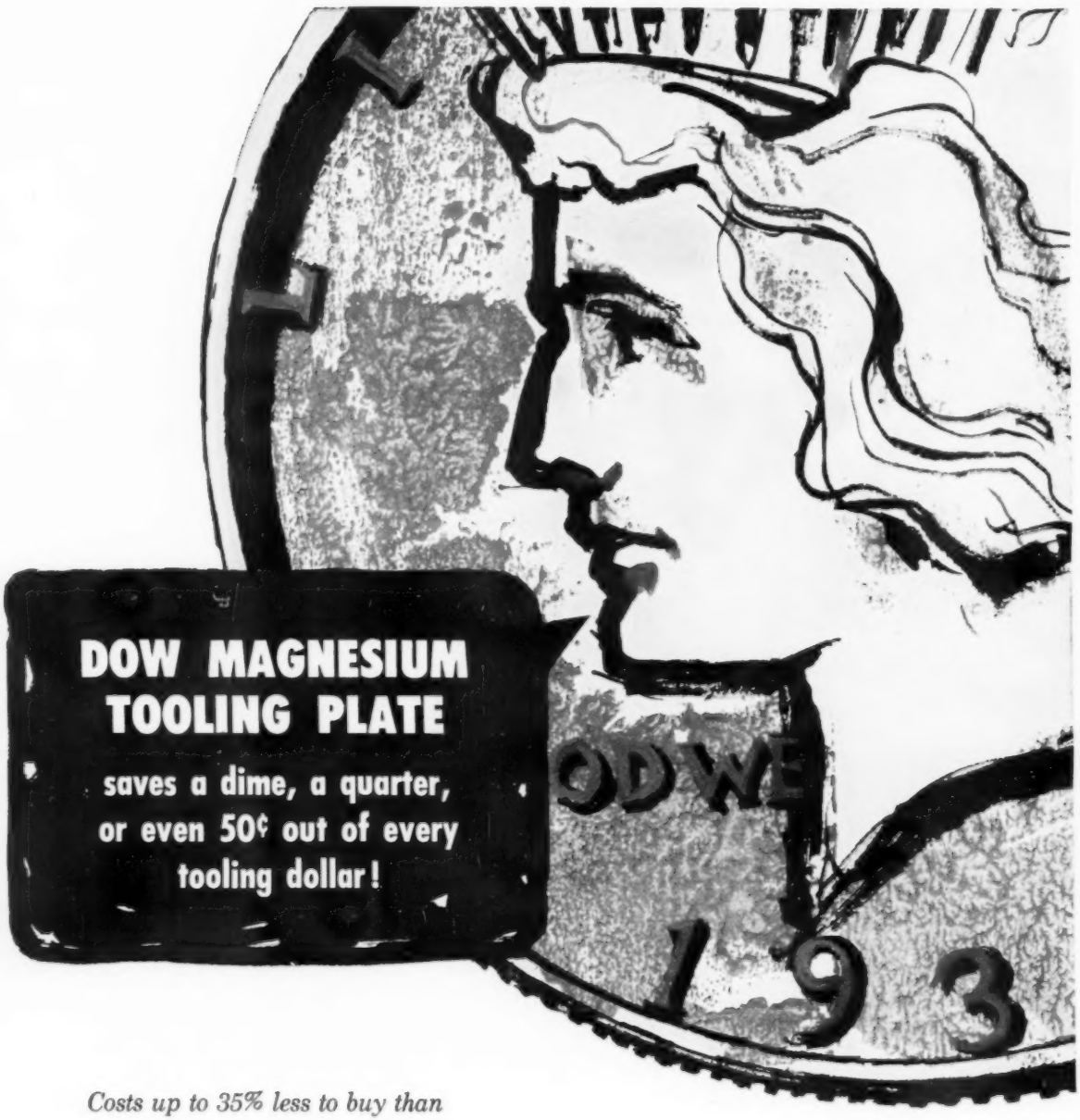
Here's the newest, roughest, toughest, fastest-working abrasive for the metalworking industry — "91" Coat RESINALL METALITE Cloth. It's the answer to your demand for more production plus more mileage. And a "91" Coat Abrasive Belt cuts faster.

Prove it on your toughest job in your own plant or at your nearest "Abrasive Tech" Methods Room — ask for a demonstration.

BEHR-MANNING CO.
TROY, N.Y.
A DIVISION OF NORTON COMPANY NORTON ABRASIVES

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
In Canada: Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., Troy, N.Y., U.S.A.

A-5



Costs up to 35% less to buy than other lightweight tooling metals

Here's why Dow magnesium tooling plate costs less to buy. The fundamental characteristics of magnesium permit rolling and oven thermal flattening to a degree of flatness and surface smoothness satisfactory for virtually all tooling uses. This flatness is not obtainable in other lightweight tooling materials without costly machining of the surface.

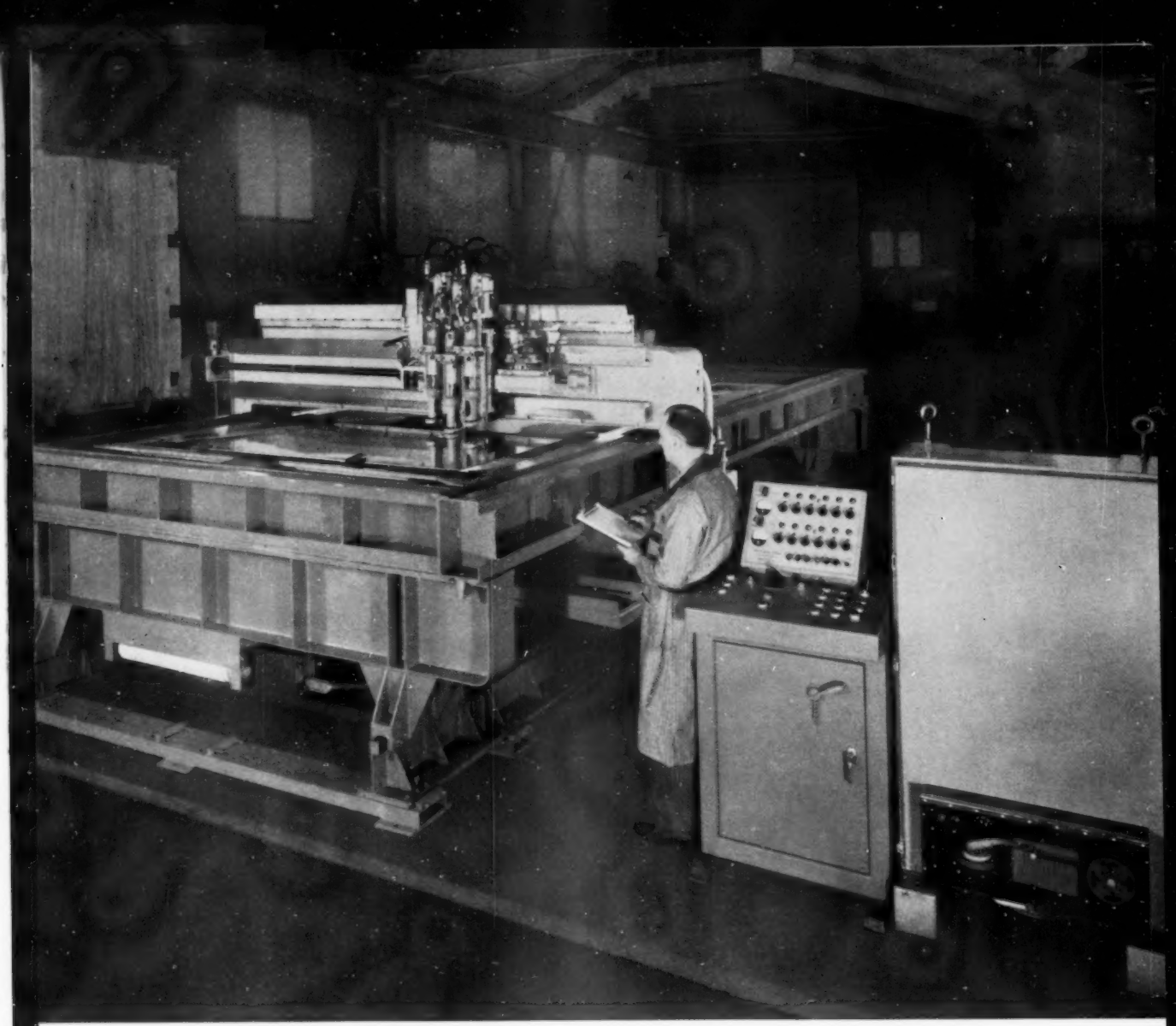
You save on fabrication costs, too. Magnesium's unsurpassed machinability saves time, effort and wear. Magnesium's lightness makes tools easier to handle during fabrication and use. Remember—magnesium COSTS LESS TO BUY, COSTS LESS TO FABRICATE, COSTS LESS TO USE!

Ask your Dow magnesium supplier for the complete story. Contact him today or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA-1427A-1

AVAILABLE FROM STOCK AT:

Copper and Brass Sales, Inc., Detroit, Michigan
A. R. Purdy Co., Inc., Lyndhurst, New Jersey
Fullerton Steel and Wire Co., Chicago, Illinois
Hubbell Metals Inc., St. Louis, Missouri
Reliance Magnesium Company, Los Angeles, California
Vinson Steel and Aluminum Company, Dallas, Texas

YOU CAN DEPEND ON DOW



Largest Automatic Precision Drill Locates, Drills and Counterbores Holes at Record Speeds

TAPE CONTROLLED MACHINE HAS AN ACCURACY OF .005" IN FULL 108" X 200" TRAVEL

Designed for aircraft work, the McKaymatic is a two dimension positioning and drilling machine that mounts three drill units on a gantry type carriage, permitting a selection of hole sizes or counterbores in a fixed work piece 9' x 16'.

Hole locations are programmed by an engineer. This data is converted into a binary code on an 8 channel 1" wide paper tape. A tape reader and decoder relays the command information through a numerical, 2 dimension positioning control to servo drives in each axis. "Farrand Inductosyn Scales" mounted on the machine locate the drills to within .005" in the full 108" (y) and the 200" (x) axis travel.

A "zero" offset unit incorporated in the control system permits fast set-up. Templates are eliminated . . . layout time and human errors are eliminated . . . floor space requirements are kept to an absolute minimum.

Because the machine can work efficiently on short runs, and can be instantly "changed over" to other work, it will cut drilling costs in many metal working applications.

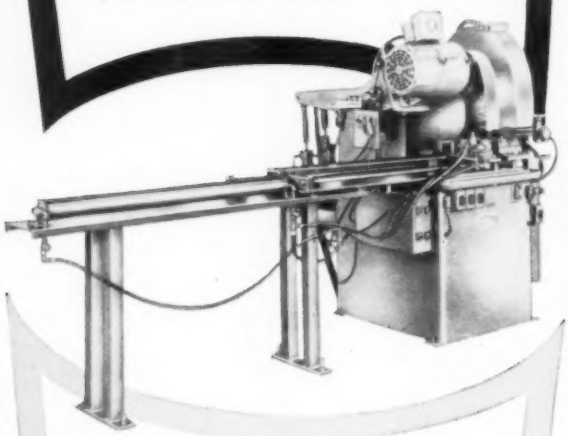
It's problem solving of this type that has made McKay an outstanding name in the aircraft, automotive, fabricating and steel industries. *The McKay Machine Company, Youngstown, Ohio.*

McKAY

MACHINE

CUT ANY METAL

Even Hardened Tool Steel in 2 to 4 seconds per square inch!



STONE

MODEL M-100
Automatic, Chop-Stroke, Cut-Off Machine

The M-100 and M-150 are designed and engineered for production-run cutting of soft to super-hard materials — swiftly, and with a mill-like finish that often eliminates surfacing operations. Extremely close tolerances are maintained day-in, day-out, on ferrous and non-ferrous bar, pipe, tubing, structurals, forms and extrusions.

Dry cutting of ferrous materials is done with an abrasive wheel without changing characteristics of the metal cut. Non-ferrous metals are cut with a steel saw blade and cooled by an oil mist spray.

M-100 FEATURES ASSURE SPEED, ACCURACY

ELECTRO-PNEUMATIC BAR FEED—Automatically feeds precise lengths of stock to preset stop. Travelling vise eliminates slippage and scratching common with ordinary feed-fingers. (Two air actuated vises hold the material on each side of the blade during the cutting cycle.)

STONE PATENTED AUTOMATIC WHEEL WEAR COMPENSATOR—For use with abrasive wheels. Automatically adjusts cutting stroke to compensate for wheel wear. Maintains fast, accurate cutting without shutdown for adjustment.

AUTOMATIC POWER STROKE CUTTING HEAD—Exclusive geared-in-head 10 or 15 H.P. motor delivers maximum power to cutting edge. Head is equipped with Power Stroke with flow control valve located in front of the machine for convenient adjustment of power stroke with ammeter, that enables operator to perform entire cutting cycle with one simple control. Saves to 25% on wheel costs.

HYDRAULIC WHEEL FEED CHECK CYLINDER—Advances wheel to cutting position rapidly—then slows wheel feed to pre-set, controlled feed of cut.

WRITE TODAY for complete information on the M-100 and other cut-off machines by STONE. 15 Models available in 3½ to 20 H.P., manual, semi- or fully automatic operation. Call your nearest dealer.

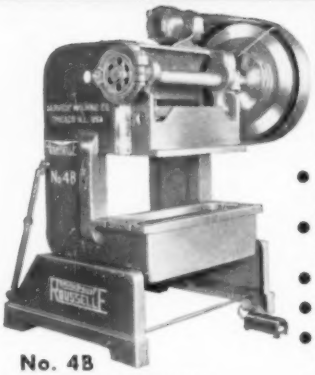
". . . represented in every major industry throughout the world"

STONE MACHINERY COMPANY, INC.

31 Fayette Street, Manlius, New York

USE READER SERVICE CARD; INDICATE A-8-182-1

New 40-TON DOUBLE CRANK O.B.I. ROUSSELLE



No. 4B
ROUSSELLE PRESS

WITH NEW ELECTRICALLY CONTROLLED AIR CLUTCH

- "Plug-in" foot and hand controls.
- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
- Roller bearing flywheel.
- Bronze main and crank bearings.

CHOICE OF 30 SIZES AND TYPES IN 5 TO 40-TON PRESSES

SERVICE MACHINE CO.

Mfrs. of Rousselle Presses

2310 WEST 78th STREET • CHICAGO 20, ILLINOIS

ROUSSELLE PRESSES ARE SOLD EXCLUSIVELY THROUGH LEADING MACHINERY DEALERS

USE READER SERVICE CARD; INDICATE A-8-182-2

Drill Hardened Steels without Annealing—

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY, INC.

1414 East 222nd St. • Cleveland 17, Ohio

"HARDSTEEL"

USE READER SERVICE CARD; INDICATE A-8-182-3

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BTR blanking die trims costs of power mower parts

This is part of a blanking die, made of BTR tool steel, which was manufactured recently by American Machine & Tool Co., Minneapolis, for use in forming a sheet-steel foot rest for a power mower.

"We first discussed the job with Paper Calmenson and Company, Bethlehem's local tool steel distributor," said one of American's engineers. "Their recommendation was BTR . . . because it's safe-hardening, tough, and has plenty of resistance to wear. It was a good choice. The die performed well, and our costs were kept low."

BTR (Bethlehem Tool Room) is our general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel. Time after time it gives long service, and trims down those production costs. That's why manufacturers keep coming back for more, and for a wide range of applications.

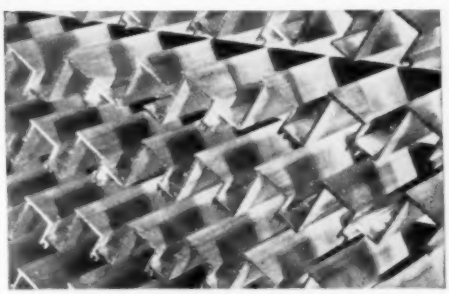
If you haven't yet experienced the advantages of BTR in your shop, why not order enough for a trial run from your Bethlehem tool steel distributor? It's one of the wisest moves you can make. Give him a call right now, while you have it in mind.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Letter Stamping Should Be Avoided

Many tools are stamped with number or letter die-stamps for identity, or to incorporate such information as size. But stamped impressions introduce sharp notches which serve to concentrate stresses both in the hardening operations and in service, and cause many service failures which would not have occurred in the absence of stamping. It is impossible to predict which stamped characters will cause trouble due to cracking. Often identical stamped tools develop little or no cracking through stamped characters, while duplicate lots may show a high percentage of such cracking.

Avoiding the use of stamped characters in tools and dies will be found to improve the service life, if a statistically large group of tools is studied. This result does not always occur on single tools, nor on a small number of tools. Yet there is no doubt that the elimination of stamping benefits tool life. In the light of present-day knowledge of the effects of stress concentration, it is intolerable that such stress-raisers as stamp marks be put on tools and dies intentionally. Stamping of characters can be avoided by resorting to the use of paint, labels, etching, or "electric pencil" to place the necessary information on the tool surfaces.



PATTERN IN EXTRUSIONS. These long metal extrusions, made by American Aluminum Extruders, Miami, were formed with a die of Cromo-WV. This grade, with its .30 pct vanadium content, is a modification of Cromo-W, our general purpose hot-work steel. Cromo-WV is an excellent tool steel grade for extrusion work because it has a well-balanced combination of properties: wear resistance, red hardness, and shock resistance, plus resistance to heat-checking.

Acme-Fette rolls threads to tight "specs"

...WITHOUT MAJOR INVESTMENT

The tool engineers of Air-Hydraulic, Inc. were faced with rigid specifications and the necessity of an extremely fine fit and finish for this high temperature hydraulic actuator for aircraft use. Conventional thread cutting methods would have been costly.

After careful study they found that Acme-Fette thread rolling heads would meet all requirements when applied to their *existing turning equipment.* Major machine investment was eliminated and a low rejection rate meant additional economies because threading was the last of a number of costly operations.

The Results

- 1"-20, ¾"-16, and 5/16"-24 threads were rolled 5 times faster than possible with conventional thread cutting dies —thread rolling speeds are equal to turning speeds with high speed tool steels.
- Cold-forming action of the Acme-Fette produced a tougher thread and one 60% smoother than grinding or chasing (a 5 micro-inch finish).
- Rejection rate: less than ½ of 1%.

For cost-reducing ideas showing how you can put Acme-Fette self-opening thread rolling heads to work on your present equipment, send for Bulletin NAF-57A.

The Material

- Steel: 4340—upset forging
- Tensile strength: over 160,000 p.s.i.
- Hardness: 36-40 on Rockwell C scale

National Acme

THE NATIONAL ACME COMPANY
193 East 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

(Above) Red-hot steel slabs, weighing over 2 tons each, are at arm's length from hydraulic lines filled with Irus Fluid 902—YET NO FIRE HAZARD.

(Right) The distinctive yellow color of Irus Fluid makes it easy to spot and trace hydraulic line leaks.

"After numerous tests, we selected Shell Irus Fluid 902 because of its excellent fire resistance and low cost,"

says Norman Bracht, Lubrication Engineer, Alan Wood Steel Company, Conshohocken, Pa.

A fire in the strip mill, causing serious equipment damage and plant down time, convinced the Alan Wood Steel Company that a switchover to a fire-resistant hydraulic fluid was imperative. After extensive testing with various commercial types, Shell Irus Fluid 902 was selected. Now . . . twelve months later . . . Alan Wood is convinced that serious hydraulic fires in strip mill tilt table are a thing of the past.

Irus* Fluid 902 is a specially compounded water-in-oil emulsion which has exceptional fire resistance. Plant tests show, time after time, that Irus Fluid 902 *actually snuffs out fire!*

Many plant operators, like Alan Wood Steel, have discovered that Irus Fluid is economical . . . costing up to one-third less than other fire-resistant fluids, yet its performance is comparable in every practical respect.

If your present hydraulic equipment is vulnerable to accidental fire hazard, we suggest that you obtain complete technical information on Shell Irus Fluid 902. Write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y. or 100 Bush Street, San Francisco 6, California.

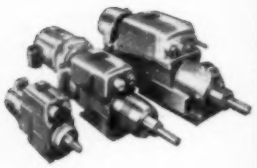
*Registered Trademark

SHELL IRUS FLUID 902

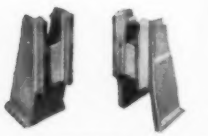
a low-cost, fire-resistant hydraulic fluid

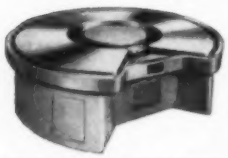
SHELL

THE COST CUTTING METHODS you need AT A PRICE you can afford

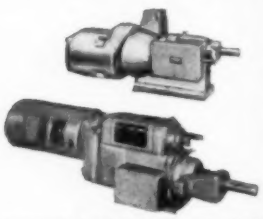


Air Hydraulic Drill Units





Circular Machine Base and Columns



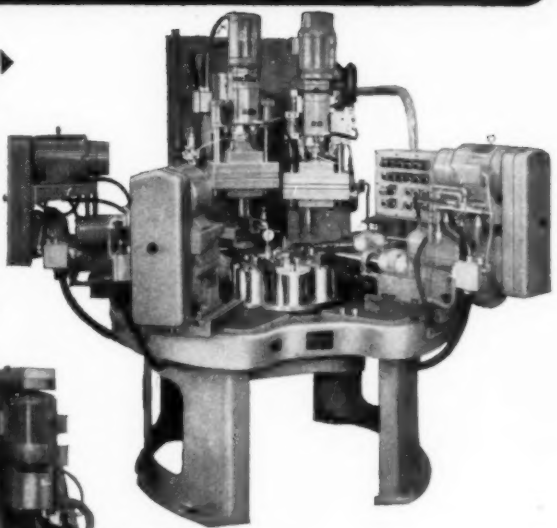
Automatic Lead Screw Tapping Units

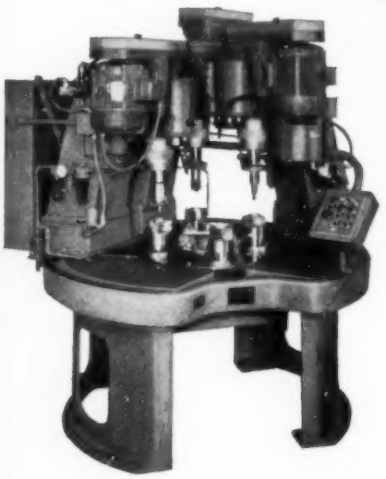
Rectangular Machine Base

EXAMPLE* ▶

A high speed indexing machine to drill and lead screw tap horizontal opposed pipe ports and two vertical mounting holes in stainless steel valve bodies at 320 parts per hour. Standard automatic self-centering Skinner air chucks hold parts.

Photo courtesy of The Skinner Chuck Company





◀ **EXAMPLE***

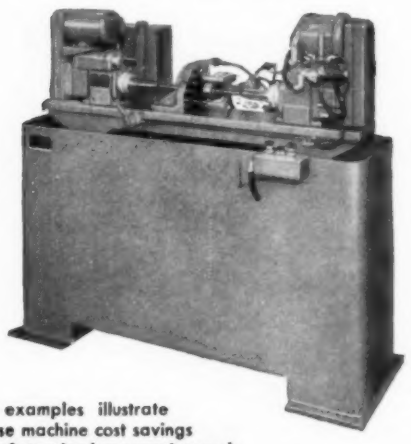
Combination drill, bore and face plus two tapping operations in die cast regulator valve spring cages. Capacity: 450 parts per hour.

Photo courtesy of Watts Regulator Company

EXAMPLE* ▶

Double end opposed combination ream and face die cast piston plates to close tolerance. Simplified air-manual fixture loading permits production of 423 parts per hour.

Photo courtesy of Bendix Products Division Bendix Aviation Corporation



***Note**

The above examples illustrate single-purpose machine cost savings through use of standard pre-engineered components. The components, bases, columns, adapters and units as shown, are available for machines built by you or for you from Hartford Special.

Write today for full information and name of our nearest field man—a specialist in low cost production techniques.

HARTFORD Special

THE HARTFORD SPECIAL MACHINERY CO.
MACHINE TOOL DIVISION
2808 HOMESTEAD AVENUE, HARTFORD 12, CONN.

TOOLING FOR THE SPACE AGE!

ASTE WESTERN TOOL SHOW

AND CONFERENCE

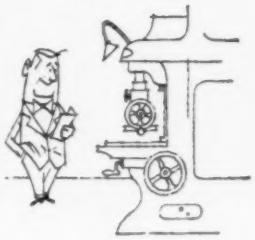
SHRINE EXPOSITION HALL
LOS ANGELES—SEPT. 29-OCT. 3

For more information, write:
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVE.
DETROIT 38, MICH.

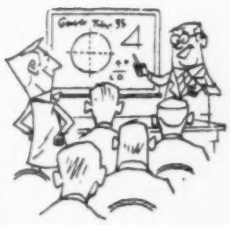
AMERICAN SOCIETY OF TOOL ENGINEERS
TOOL SHOW CONFERENCE '58 SEPT 29 - OCT 3

SEE everything that's new in tooling and production equipment.

All the very latest advances and improvements in more than thirty basic categories of industrial products will be on display. It's your chance to see tooling's future, *your* future at one time under one roof. Don't miss it! Plan *now* to attend the West's most outstanding industrial event.



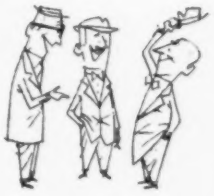
ATTEND fact-packed technical conferences, symposia and panels.



Fifteen major symposia and panels . . . conducted by eminent authorities . . . will be devoted to subjects of vital interest, including: Tooling Space Airframes; Sandwich Construction for Aircraft; Forming the Exotic Metals; Tooling for Electronics; Numerical Control in Missile Production; Plastics in Tooling.

MEET the men who make the wheels of Western industry go 'round.

What better opportunity to meet and exchange ideas with management, engineering, design, production and industrial sales people? And what could be more important, in today's highly competitive market, than to be informed and up-to-date on all the latest production developments?



INSPECT some of the finest plants in the Los Angeles Area.

You'll see industry in action, too. Plant tours scheduled include: Byron Jackson Tool Co.; Douglas Aircraft Co.; Long Beach Naval Shipyard; Crown Zellerbach Corp.; Consolidated Electrodynamics; Hughes Products Div., Hughes Aircraft; United States Electrical Motors; American Can Co.; Mercury Div., Ford Motor Co.; Lever Bros. Co.; Northrop Aircraft Co.

FOR CLEANER ZINC AND ALUMINUM CASTINGS

FISKE'S DIE CASTING COMPOUNDS

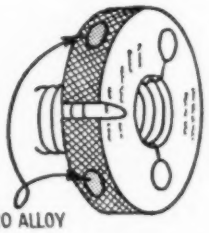
These compounds are made in several grades to meet various application requirements such as brushing, swabbing, or spraying. Permit greater production because of more pieces between applications. Improves surface finish . . . prevents sticking and soldering . . . minimizes carbon formation . . . reduces fumes and smoke. Bulletins describing Fiske's Die Casting Compound and other specialty lubricants and coolants sent on request.

FISKE'S *Since 1870* METAL WORKING LUBRICANTS

FISKE BROTHERS REFINING CO.

129C LOCKWOOD STREET, NEWARK 5, N. J.
Plants: Newark 5, N. J. and Toledo 5, Ohio

USE READER SERVICE CARD; INDICATE A-8-188-1



CERRO ALLOY

HOW TO Seal Adjustment Screws on Gages, Instruments, Etc., *easily, securely . . . with* CERRO* ALLOYS

CERROBEND®, a low-temperature-melting CERRO ALLOY, is the ideal material for sealing adjustment screws on delicate instruments. CERROBEND is easy to work with . . . neat . . . strong . . . versatile. It rapidly solidifies, expands and locks in place in the adjustment screw cavity, prevents loosening of the screw from vibration or tampering. CERROBEND ALLOY is easily melted out in hot water or at hot water temperature.

CDEP

This is only one of 63 CERRO ALLOY applications. For the complete lising send for our new information-packed "HOW TO" (#J4) booklet.

CERRO DE PASCO SALES CORPORATION

Room 1503, 300 Park Avenue, New York 22, N. Y.

*T.M. Cerro de Pasco Corporation

USE READER SERVICE CARD; INDICATE A-8-188-3

"MONOBALL"® Self-Aligning Bearings

CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Moly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Moly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Dept. TE-58

SOUTHWEST PRODUCTS CO.
1705 SO. MOUNTAIN AVE., MONROVIA, CALIFORNIA

USE READER SERVICE CARD; INDICATE A-8-188-2

IMPORTANT

Exhibitors at the ASTE WESTERN TOOL SHOW—September 20 - October 3—are advised to be well stocked with order pads. (81% of the key executives who attend ASTE TOOL SHOWS *BUY* or recommend buying at the SHOW!)

For information on exhibit space, phone or write:

Exposition Committee
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan
UNiversity 4-7300

TE-2

"The Board balked at first...

but I convinced them that now was a good time to buy!"

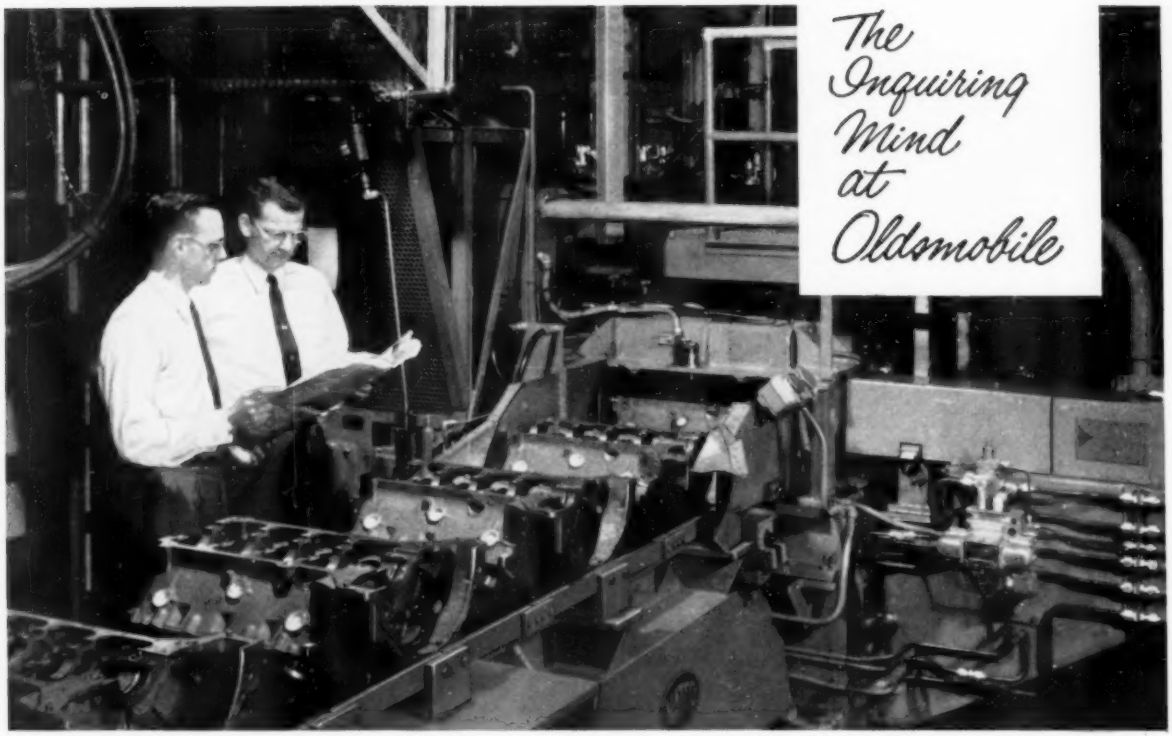
When machine tool builders work with smaller backlogs they're naturally more efficient and can make better deliveries... are more able to control costs ...more able to render the many *extra* custom engineering services that disrupt regular production during peak schedules. As a matter of fact, many progressive buyers are at their busiest now... taking advantage of the sound buying position the economy gives them as it pauses for its breath... seizing the opportunity to get ready for tomorrow today.

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

BLISS is more than a name... it's a guarantee

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.



The Inquiring Mind at Oldsmobile

no. 4 OF A SERIES

BEARINGS SO PERFECT YOU CAN "ROLL YOUR OWN"

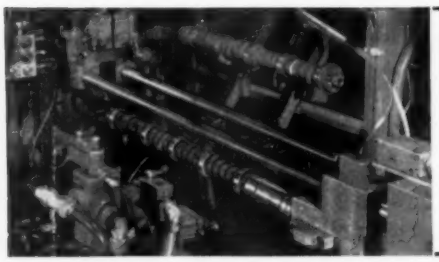
Automatic camshaft assembly machine assures bearing surfaces so perfect that every Oldsmobile camshaft can be turned by hand.

Installing a camshaft in an engine is like threading a needle. In the hand assembly of this critical part, the cam lobes often score the bearing surfaces. This results in high friction that will 'freeze' a camshaft so that it can be very difficult to turn manually. Olds engineers, however, have developed the only automatic camshaft assembly machine in existence. It installs camshafts so precisely that every one can easily be rotated by hand . . . a guarantee of unmarred cam lobes, less friction and *longer bearing life!*

To go one step further in eliminating any possibility of damaged cam lobes and journals, all handling is done entirely by mechanical means. After grinding, polishing and washing, camshafts are fed by conveyor to the installation machine and mechanically loaded. As the camshaft is properly installed and located in the engine block, a uniform protective coating of oil is applied for proper lubrication before the engine is ever started. So precise is this machine that cam bearings are never touched by the lobes or journals passing through even though clearances are as low as 0.0015 inches.

Attention to small, frequently hidden details is the true mark of quality craftsmanship. At Oldsmobile, quality is not "What will pass?", but rather, "Is this the *best* way to build automobiles?". It is this search for better ways to make better automobiles that makes Oldsmobile distinctive—a car in a class by itself. Discover the difference for yourself. Your friendly Oldsmobile Quality Dealer has a test drive reserved especially for you.

OLDSMOBILE DIVISION, GENERAL MOTORS CORP.



◀ Camshaft is rotated and lubricated as it automatically slides into engine block.

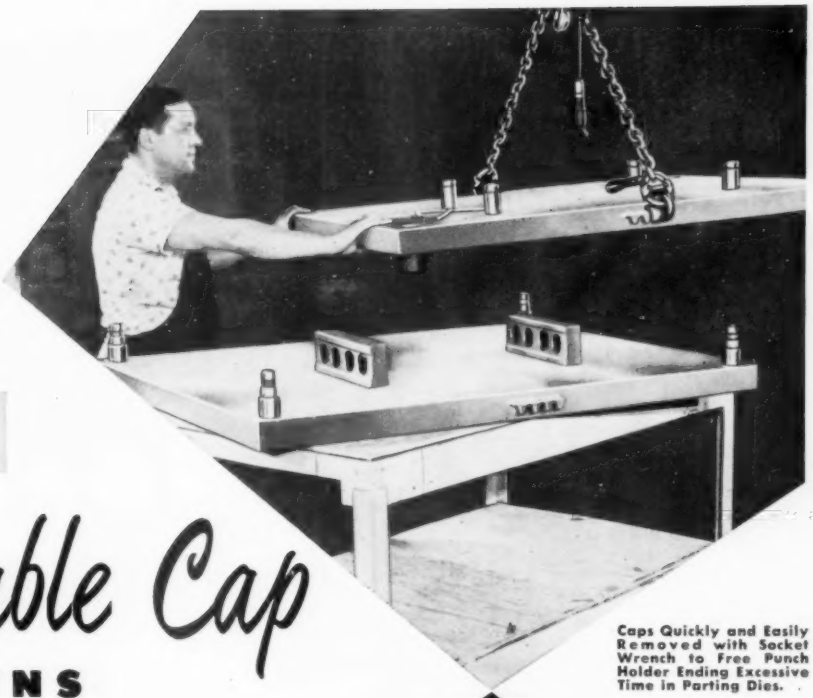
Scarred lobe on camshaft ▶ indicates scored bearing and may result in shorter camshaft and bearing life.

OLDSMOBILE **Pioneer in Progressive Engineering ...Famous for Quality Manufacturing**

one man parts large die set in 3 minutes *with*

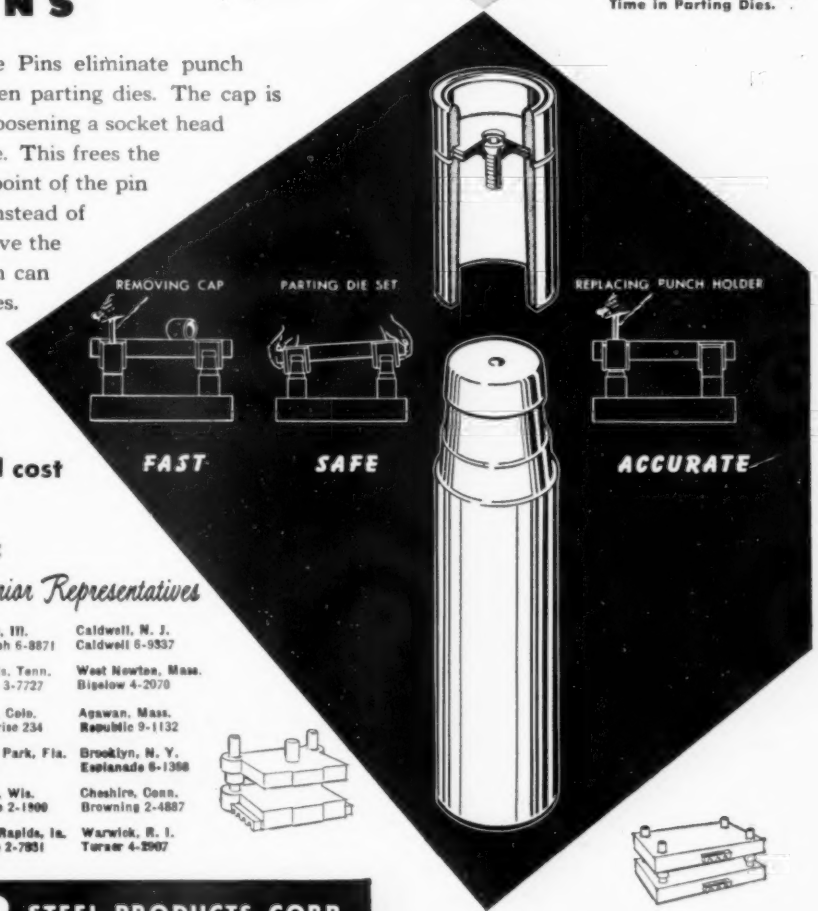
SUPERIOR

Removable Cap
GUIDE PINS



Caps Quickly and Easily Removed with Socket Wrench to Free Punch Holder Ending Excessive Time in Parting Dies.

Superior's Removable Cap Guide Pins eliminate punch holder binding on guide posts when parting dies. The cap is removed from the pin merely by loosening a socket head screw which holds the cap in place. This frees the punch holder at the most critical point of the pin where it is apt to cock or bind. Instead of needing 2 or 3 die makers to remove the punch holder from a set, one man can do this work alone in a few minutes.



NOW on every Superior die set in diameters from 1½" upward at no additional cost

For Fast Local Service Call these Expert Superior Representatives

2 PLANTS TO SERVE YOU
Milwaukee, Wis. Mitchell 5-8027
Plainville, Conn. Sherwood 7-2751

Kalamazoo, Mich. Fireside 5-7988	Chicago, Ill. Randolph 6-8871	Caldwell, N. J. Caldwell 6-9337
St. Louis, Mo Jefferson 5-1223	Memphis, Tenn. Fairfax 3-7727	West Newton, Mass. Bigelow 4-2070
Indianapolis, Ind. Clifford 5-5668	Denver, Colo. Enterprise 234	Agawam, Mass. Republic 9-1132
Rockford, Illinois 3-3851	Winter Park, Fla. 4-0484	Brooklyn, N. Y. Esplanade 6-1368
Dayton, Ohio Hemlock 6209	Racine, Wis. Melrose 2-1900	Cheshire, Conn. Browning 2-4887
Minneapolis, Minn. Franklin 1-1321	Cedar Rapids, Ia. Empire 2-7851	Warwick, R. I. Turner 4-2907

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-191

New Economy and Speed in Tooling Production for the Airframe Manufacturer with POLYTOOL

Photos courtesy of Arrowsmith Plastic Tooling, Inc., Los Angeles, Calif.

RCI EPOXY PLASTIC TOOLING COMPOUNDS

In the photos above you see a completed plastic stretch die and the laminating build-up stage in its fabrication.

This plastic stretch die has excellent dimensional stability. It is lightweight and was produced fast at low cost.

Reichhold, a basic manufacturer of resins, offers you a full line of epoxy plastic compounds for tool production.

POLYTOOL 2501 (white finish) and **2551** (metallic) are epoxy plastic tooling compounds for casting and laminating applications.

POLYTOOL 2502 (white finish) and **2552** (metallic) are epoxy plastic tooling compounds for gel coat application.

Reichhold supplies low irritation **POLYTOOL HARDENERS** for varying the gel time of these compounds. Reichhold also furnishes POLYTOOL compounds for a 3-component system with which you can vary working properties to meet specific requirements.

Why not investigate the **RCI POLYTOOL** line of plastic tooling materials? It includes not only epoxy, but also polyester, phenolic and polyurethane resin systems. RCI offers you outstanding quality control of these materials.

REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenol
Sulfuric Acid • Methanol

REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N.Y.

Creative Chemistry... Your Partner in Progress

RCI

INGENIOUS NEW... UNIVERSAL R&R DEBURRING TOOL

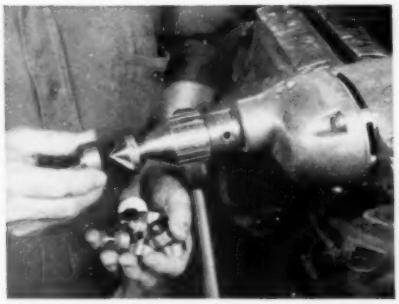
with spring loaded retractable blade

eliminates chatter

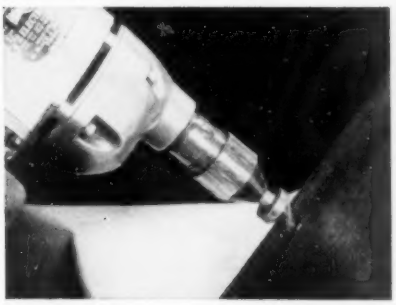
gives precision-cut edge or

chamfer at high speed

The cutting action of Model 955 Universal R&R chatterless Deburring Tool (on the left) is effected by spring tension against the blade. On Model 956, right, the spring tension is against the body. This is adjustable to regulate the depth of cut. The blade is free-floating to allow self-alignment and uniform stock removal.



The new Universal R&R Tool makes a handy horizontal deburrer when used with a portable drill held in a vise. With proper adjustment, the R&R Deburring Tool is CHATTERLESS. A new design allows the bearing angle of the tool body and the blade to be in continuous contact with the work piece at all times.



R&R Deburring Tool used in electric drill as a portable unit for heavy plate or other objects too heavy to handle. Blades of the R&R Deburring Tool are replaceable at nominal cost from stock. They are made of high speed steel, precision hardened and ground to close tolerances for interchangeability.

Used in any standard drill press at the high operating speeds recommended by the makers of high speed steels, the R&R Deburring Tool performs most efficiently. High operating speeds mean more production, lower costs. Each tool is made in a full range of sizes to 1½" diameter.

UNIVERSAL ENGINEERING COMPANY | FRANKENMUTH 3, MICHIGAN

209

WILSON "ROCKWELL"

HARDNESS TESTERS

WORLD'S STANDARD OF ACCURACY

ACCO for Better Values

EQUIPMENT for EVERY Hardness Testing Requirement

No matter what your hardness testing requirements are, there's a WILSON "ROCKWELL" instrument to do the job. Choose from this complete selection of hardness testers:

"ROCKWELL"—for most hardness testing functions.

Superficial—for extremely shallow indentations.

Twintester—combines functions of "ROCKWELL" and "ROCKWELL" Superficial testers.

Semi-Automatic (manual feed) and Fully Automatic—for automatically classifying tested pieces as CORRECT, TOO HARD, or TOO SOFT—at test rates up to 1000 pieces per hour.

Special Machines—for testing large objects, obtaining internal readings, and other unusual applications.

ALL WILSON "ROCKWELL" hardness testers provide these advantages:

Accurate performance—precision built, with exact calibration, for consistently correct results.

Long life—durable as a machine tool.

Easy operation—even an unskilled operator can get perfect readings. All controls conveniently grouped.

Easy maintenance—interchangeable mechanisms, with spindles mounted on oil-less bearings.

DIAMOND "BRALE" PENETRATORS
for perfect testing every time

A perfect diamond penetrator is essential to accurate hardness testing. Since one point of hardness on the "ROCKWELL" scale represents only 80 millionths of an inch of penetration—only 40 millionths on a Superficial tester—the slightest imperfection will cause a false reading.

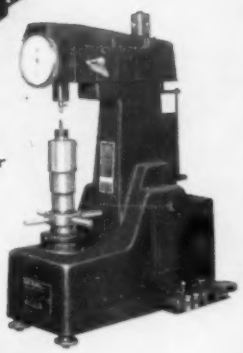
Only *perfect* Wilson Diamond Brale Penetrators are sold. Each diamond is flawless, with no chips or cracks. It's cut to an exact shape. Microscopic inspection and a comparator check of every diamond—one at a time—assure this perfection—and assure you of accurate hardness testing every time.

A COMPLETE LIBRARY of Helpful Information

A wide variety of bulletins tells about hardness testing, and describes the many instruments, accessories, and services Wilson offers. Write for your choice:

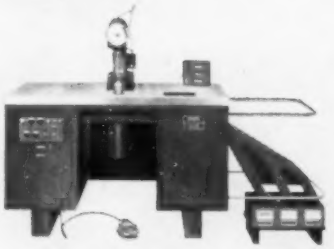
DH-325—WILSON "ROCKWELL" Hardness Testers • **DH-326**—"ROCKWELL" Superficial Hardness Testers • **TT-58**—"ROCKWELL" Twintester • **DH-327**—Special "ROCKWELL" Testers, including Automatic and Semi-Automatic models • **DH-328**—TUKON Tester, for precision MICRO and MACRO testing

"ROCKWELL"



Twintester

Superficial



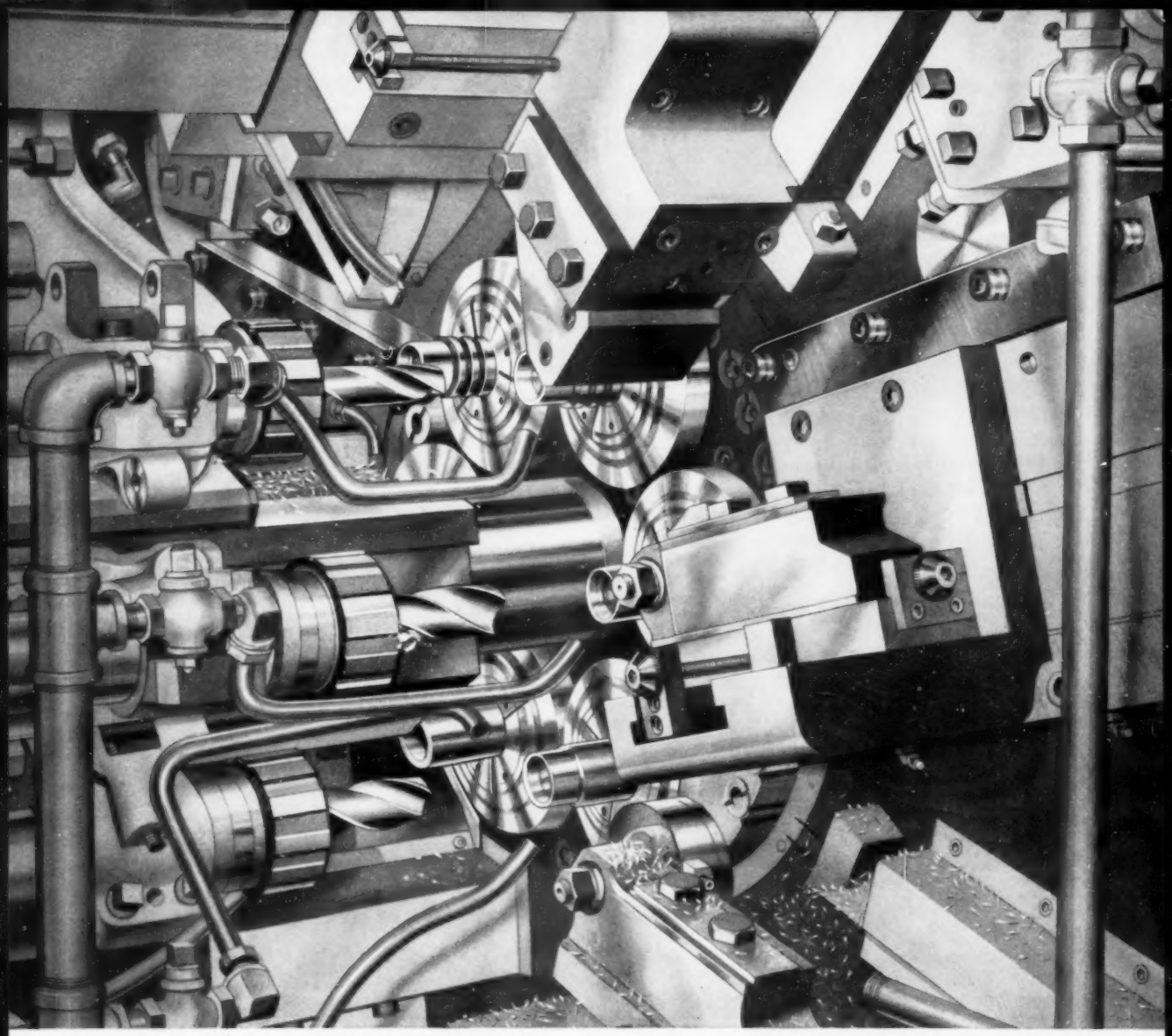
Automatic

TUKON Tester (for MICRO and MACRO testing)

ACCO **WILSON**

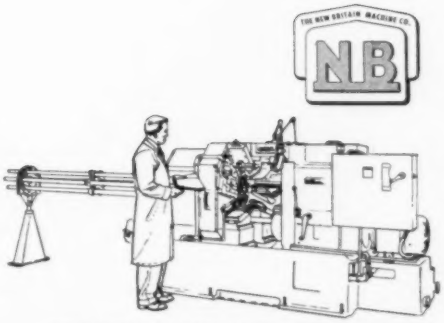
MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE

230-H Park Avenue, New York 17, N. Y.



for lower costs — put more tools to work

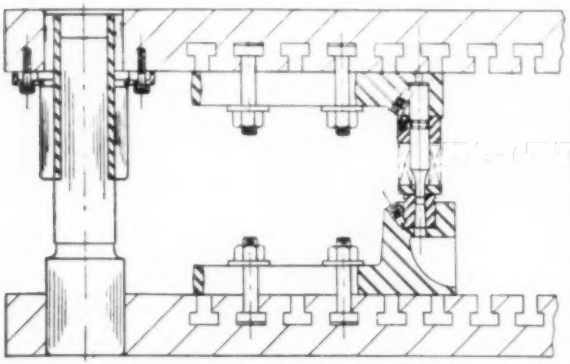
You can make money with the speed, versatility, accuracy and extra operations possible on the *new* New Britain Automatic Bar Machines with independent radial cross slides in all six positions. More operations per machine, at higher speeds and feeds, mean more completed pieces in the pan, faster than ever before. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



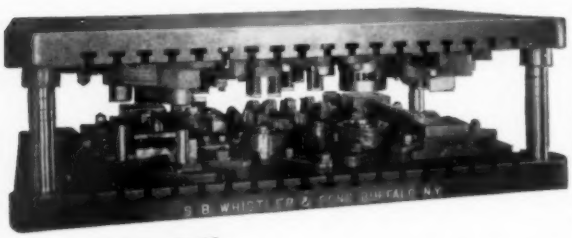
NEW BRITAIN AUTOMATIC BAR MACHINE

ADJUSTABLE DIES by WHISTLER

• Operate like a single purpose die • Easy to set-up and make changes • Interchangeable and re-usable parts always ready for a new job • Reduce die costs to a new low • Pierce holes in any desired arrangement of shapes and sizes • Precision piercing of materials to ¼" thick steel.



Above: Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.



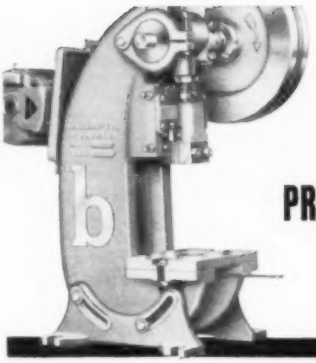
YOU NEED THIS CATALOG

to see for yourself in dollars and cents what this adjustable die making method can do for your plant. Send for it right now...without obligation.

S. B. WHISTLER & SONS, INC.
744 Military Road, Buffalo 23, N. Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

USE READER SERVICE CARD; INDICATE A-8-196-1



THERE'S A BENCHMASTER FOR EVERY PRESS OPERATION

at ratings from 2 to 10 tons!

Benchmaster gives you a series of proven presses and press designs – backed by 20 years of industrial use – with stock parts and dealers from coast to coast!

Benchmasters are the *accepted* presses – standards of the industry for all light tonnage applications.

Made in 2, 5, 8 and 10 ton capacities in Plain OBI, Back-Geared, Deep Throat, Fixed Bed Gap Frame, Multiple Ram and Half Press models with mechanical, air or electric clutches. Also available: Mechanical 2 hand trip lever or 2 hand solenoid operation for maximum safety.

When you need a press for *any operation*, check with Benchmaster ... *known for service, for reliability ... for over-all press versatility, and for low cost!*

benchmaster

World's largest manufacturer of small punch presses and mills.

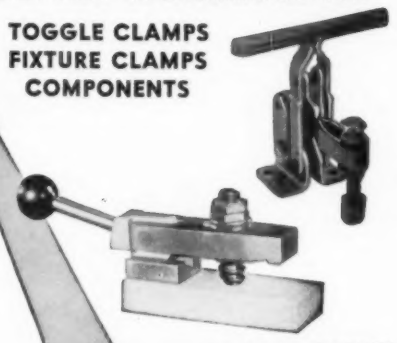
1835 W. Rosecrans Avenue • Gardena, California

USE READER SERVICE CARD; INDICATE A-8-196-2

WESPO *Used by LEADING PLANTS* for BETTER WORKHOLDING

TOGGLE CLAMPS
FIXTURE CLAMPS
COMPONENTS

ASTE DATA SHEETS

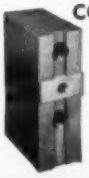


TOGGLE CLAMPS Over 80 TYPES & SIZES

• • •

FIXTURE CLAMPS Over 170 TYPES and SIZES

COMPONENTS Over 1,000 TYPES and SIZES



Write for CATALOG
TOGGLE CLAMPS
FIXTURE CLAMPS
& PARTS

WEST POINT MFG. CO.
, Mich.

USE READER SERVICE CARD; INDICATE A-8-196-3

Again, it's 921-T

What more can *WE* say?

American Machine & Mfg. Co.

P. O. BOX 542

95 PROGRESS STREET

UNION, NEW JERSEY

MECHANICAL AND ELECTRICAL APPARATUS :: SOLENOIDS, COILS, ELECTROMAGNETIC DEVICES

April 24, 1958

Mapes & Sprowl Steel Co.
P. O. Box 425
Burnet Avenue
Union, New Jersey

Attention: Mr. Colen B. Hecox

Reference: Use of Pioneer #921-T Aluminum for Conveyor Wheel in our pencil ferrule striping machines.

Gentlemen:

In order to obtain required accuracy, speed of operation, and reduction in machining cost, we changed from steel to Pioneer #921-T in the construction of the last 10 machines referred above.

The following reasons prompted us to change to Pioneer #921-T:

1. Flatness of material.
2. Lower indexing inertia of arbor wheel due to lighter weight of material.
3. Higher stability under heated operating condition.
4. Substantial savings in machining 144 arbor holes on 23" dia. B.C. which had to be held to .003" T.I.M.

You will find, herewith, a photograph of the referred machine.

This letter is our authorization to use either the picture herewith, our letter or both.

Yours Truly,

AMERICAN MACHINE & MFG. CO.

Paul E. Plante

Paul E. Plante
Partner

Tooling and Production ENGINEERS Agree on 921-T

Paul Plante of American Machine & Mfg. Co. leaves nothing unsaid in stating why Pioneer 921-T Cast Aluminum Tooling Plate was adopted as the ideal material for fast precision machining, with plus advantages of inherent stability and lighter weight than steel. Maybe you have a special production problem that can be solved by Pioneer 921-T. Write for case history bulletin.

PIONEER ALUMINUM INC.

Subsidiary of Morris P. Kirk & Son, Inc.
Pacific Coast Unit of National Lead Company

5251 W. Imperial Hwy., Los Angeles 45, Calif.
Phone: ORegon 8-5073

EASTERN SALES OFFICE
288 Old Country Road, Mineola, New York
Phone: Pioneer 7-6171

MIDWEST SALES OFFICE
23439 Michigan Ave., Dearborn, Mich.
Phone: LOgan 3-2708

SOUTHWEST SALES OFFICE
P. O. Box 702, Dallas, Texas
Phone: EMerson 1-2971

SPECIFY PIONEER 921-T AND ORDER FROM THESE METAL SUPPLIERS

ALBUQUERQUE, N.M.: Morris Steel & Supply Co.
ATLANTA, GA.: Reynolds Aluminum Supply Co.
BOSTON, MASS.: American Steel & Aluminum Corp.
Joseph T. Ryerson & Son, Inc.
BIRMINGHAM, ALA.: Reynolds Aluminum Supply Co.
BUFFALO, N.Y.: Joseph T. Ryerson & Son, Inc.
CHICAGO, ILL.: Joseph T. Ryerson & Son, Inc.
Kasle Steel and Aluminum
CLEVELAND, O.: Kasle Steel & Aluminum
DALLAS, TEX.: Vinson Steel & Aluminum Co.
DEARBORN, MICH.: Pioneer Aluminum Inc.
DENVER, COLO.: ABC Metals Corporation
DETROIT, MICH.: Kasle Steel & Aluminum
Meier Brass and Aluminum Co.
FT. LAUDERDALE, FLA.: Caulley Steel and Supply Co.
GRAND RAPIDS, MICH.: Kasle Steel & Aluminum
HARTFORD, CONN.: American Steel & Aluminum Corp.
HILLSIDE, N.J.: Edgcomb Steel & Aluminum Corp.
HOUSTON, TEX.: Vinson Steel and Aluminum Co.
JERSEY CITY, N.J.: Joseph T. Ryerson & Son, Inc.
KANSAS CITY, MO.: Industrial Metals, Inc.
LOS ANGELES, CALIF.: Braico Metals Co., Inc.
Continental Metals Co., Inc.
Earle M. Jorgensen Co.
Tool Components, Inc.
LOUISVILLE, KY.: Reynolds Aluminum Supply Co.
MEMPHIS, TENN.: Reynolds Aluminum Supply Co.
MIAMI, FLA.: Reynolds Aluminum Supply Co.
Caulley Steel and Supply Company
MILWAUKEE, WIS.: Joseph T. Ryerson & Son, Inc.
MINEOLA, N.Y.: Pioneer Aluminum Inc.
NASHVILLE, TENN.: Reynolds Aluminum Supply Co.
OAKLAND, CALIF.: Earle M. Jorgensen Co.
ORLANDO, FLA.: Caulley Steel and Supply Company
RALEIGH, N.C.: Reynolds Aluminum Supply Co.
RICHMOND, VA.: Reynolds Aluminum Supply Co.
SAVANNAH, GA.: Reynolds Aluminum Supply Co.
ST. LOUIS, MO.: Industrial Metals, Inc.
Joseph T. Ryerson & Son, Inc.
SOUTH BEND, IND.: Kasle Steel & Aluminum
TULSA, OKLA.: Industrial Metals, Inc.
UNION, N.J.: Mapes & Sprowl Steel Co.
WALLINGFORD, CONN.: Joseph T. Ryerson & Son, Inc.
WICHITA, KAN.: Industrial Metals, Inc.

SALES REPRESENTATIVES:
Morris P. Kirk & Son, Inc.
4050 Horton St., Emeryville 8, Calif.
Also: Fresno, Calif.; Phoenix, Ariz.; Salt Lake City
The Norwest Company
330 Second Ave. West, Seattle 99, Wash.

WORLD'S LARGEST DISTRIBUTOR OF AIRCRAFT EXTRUSIONS / MORE THAN 2,500,000 POUNDS IN OVER 7,000 SHAPES

Automatic Positioning

Reduces Production Costs with

BULLARD

H.B.M.

MODEL 75

The experience of George Hantscho Company, Inc., Mount Vernon, New York, builders of equipment for the printing industry, is typical of that enjoyed by users of Bullard H.B.M., Model 75.

THE PROBLEM

To bore 105 holes, from 5" to ½" in diameter, in both side frames of paper folding machine to support rollers, gears and folding cylinders. Some holes must be aligned vertically and others horizontally.

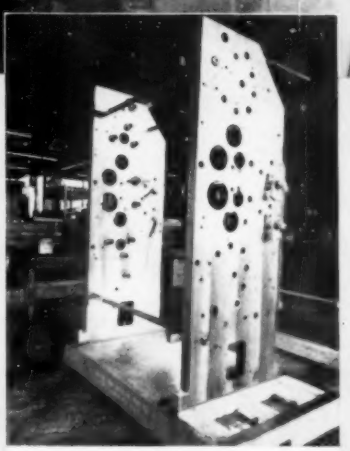
THE SOLUTION

Mount pair of side frames, ⅝" apart, on table of 4" Bullard H.B.M., Model 75, equipped with automatic table and head positioning. Bore all holes of the same size beginning with the largest and working down to the smallest.

THE ADVANTAGES

All related holes in perfect alignment — no spoilage. Less tool change-over time.

Eliminate hand measurements and templates for hole location. Accurate automatic hole location within a tolerance of ±.0004". Ease of operation from Pendant Control — less operator fatigue. Overall boring time reduced 25% over previous method.

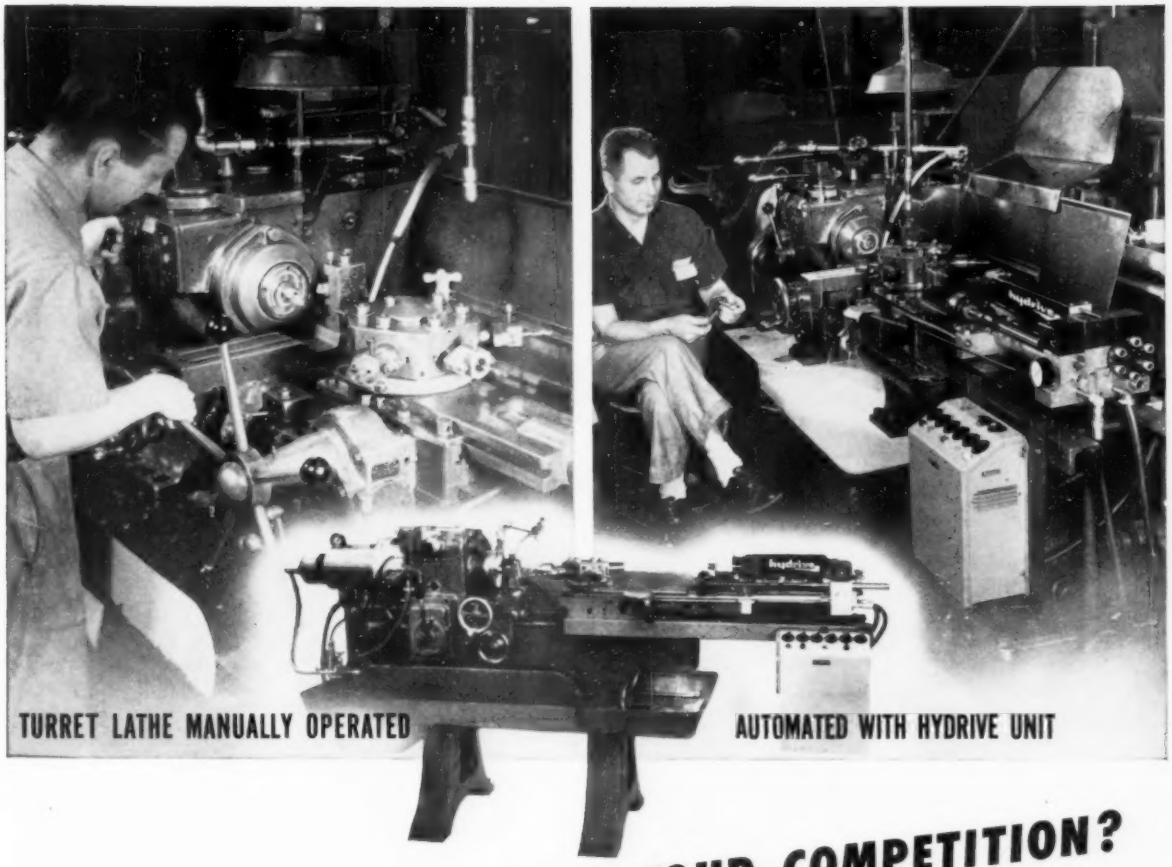


Partially assembled side frames ready for ink rollers, gears and printing cylinders.

How about your boring problems? Are you applying all the advantages of a Bullard H.B.M., Model 75 to them? If not — get the full story from your nearest Bullard Sales Engineer or write

THE BULLARD COMPANY

BRIDGEPORT 9, CONNECTICUT



CAN YOU MEET OR BEAT YOUR COMPETITION?

Comparison tests between Hydrive and manually operated turret lathes prove Hydrive superiority and speed

However, quality and precision are much more than secondary considerations. With Hydrive's hydraulically constant pressures any lateral dimension required can be maintained accurately. And with identical pressures pre-set into any production run, Hydrive will produce first and last pieces exactly the same. This consistency gives you less waste, less operator fatigue, and more inspection time. . . . Acme Hydrive will adapt to turret lathes from bench sizes to No. 5 and automatically operate the turret. Acme can automate the following functions: the cross slide, change spindle speed, advance bar stock, reverse direction of spindle rotation for tapping, and open and close collet and control them automatically with Hydrive.

For further information check this coupon. Also check for free showing of the Acme Hydrive film.

ACME

INDUSTRIAL COMPANY

208 North Laflin Street
Chicago 7, Illinois

☐ Send me your Hydrive literature.

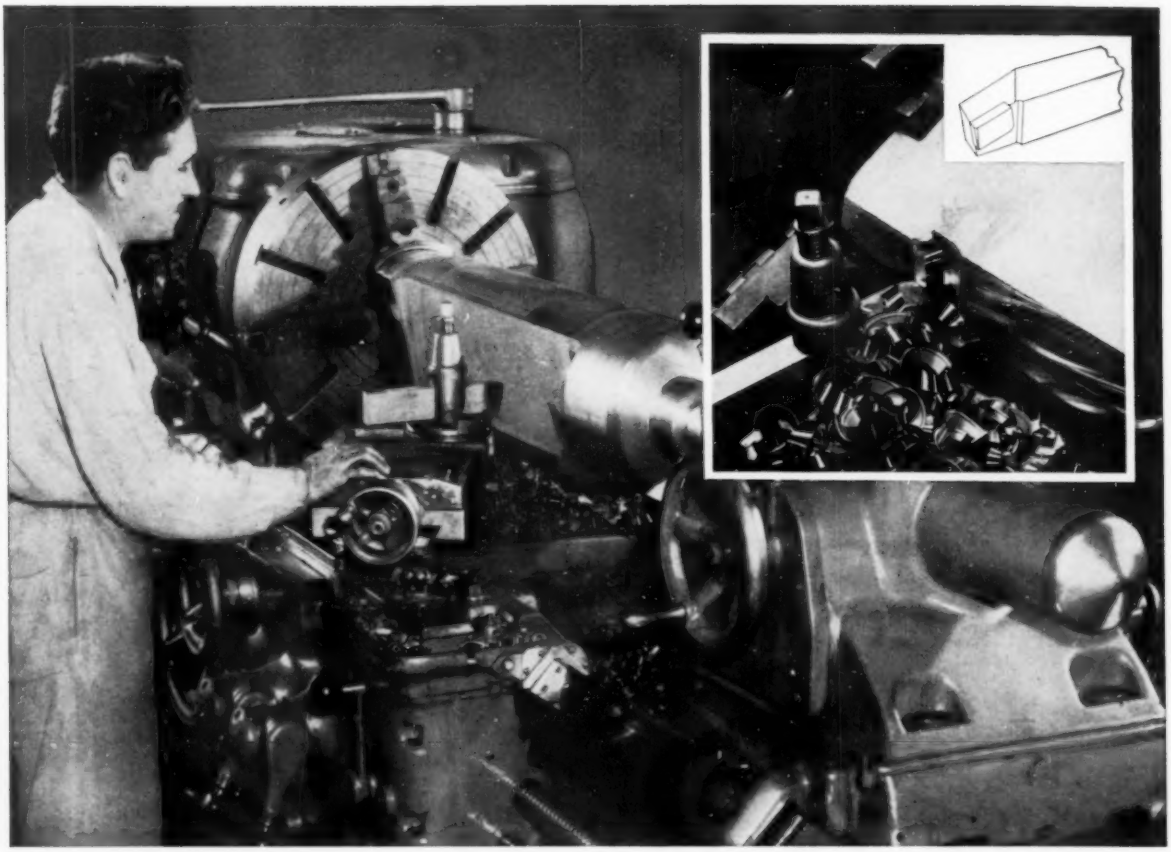
☐ Make arrangements for us to see your Hydrive film.

NAME_____

FIRM NAME_____

ADDRESS_____

CITY_____ STATE_____



Kennametal Style BL-24 Brazed Tool, modified, being used on its side as a shear angle tool on interrupted cut. Run at 207 SFM and .033" feed per revolution, this tool completes shanks four times faster than the HSS forged tools previously used.

Here's why...

KENNAMETAL* still makes brazed tools

Rapid acceptance of the Kendex* principle of throw-away insert tooling, makes it appear at times that brazed tools are "on their way out." Not by a long shot! On many short runs and on many jobs where modified tools are needed, such as illustrated, Kennametal Brazed Tools are often the best choice for tool performance and economy.

Consider the unusual job shown above, for example . . . turning rough, scaly SAE 4140 steel forgings. The 53" long workpiece has two parallel flats about 8¼" wide and 45" long. From a 12" rough-forged diameter it must be turned down to 4½" on the chuck end. When finish machined, the piece serves as the shank for a 300-ton capacity hook used in handling oil well drill pipe string. Depth of cut from ⅜" to ⅞", including about ½" of scale, plus the severe interrupted cutting for the flats, makes this a tough operation for **any** tool.

To do the job, a standard Kennametal BL-24 Brazed Tool was slightly modified into a shear angle tool to take the interrupted cut without difficulty.

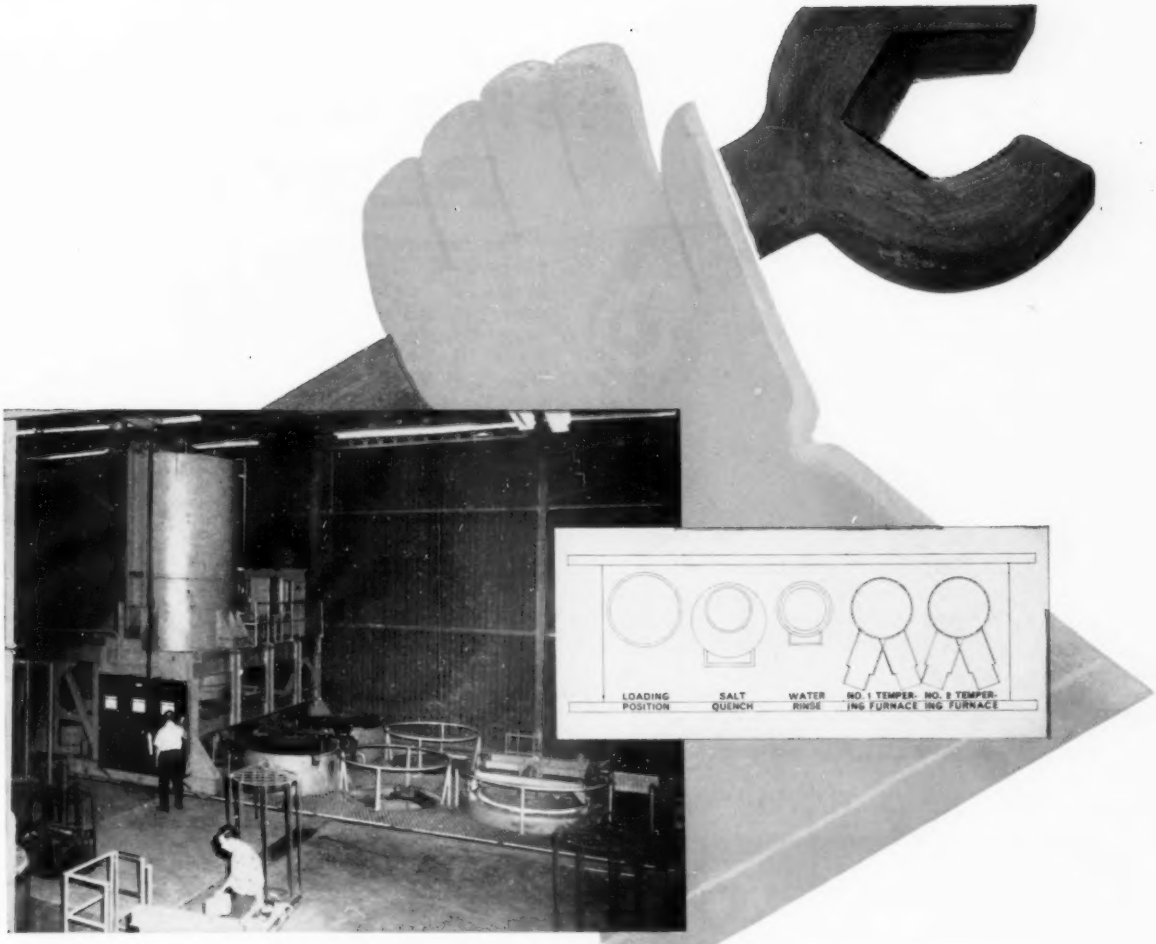
Whether you need tools for production or short runs; indexable "throw-away" insert or brazed-type tooling; standard or modified blanks; precision or utility "throw-aways"... Kennametal has thousands of items in stock to provide the right tool and grade for every machining job.

To be sure you get the most productive and economical tooling, call on your Kennametal Representative to help get Top Tooling on all your machining operations. Or write KENNAMETAL INC., Dept. FB, Latrobe, Pennsylvania, for complete information about a Top Tooling Program fitted to your needs.

*Trademark

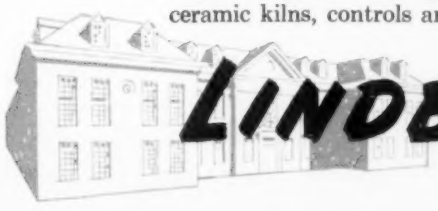
3171

INDUSTRY AND
KENNAMETAL
...Partners in Progress



Lindberg applies the creative touch to field-installation

Here is an example of Lindberg's creative touch in field-installed heat treating equipment. Our unique design of this movable overhead furnace saved space, labor and time and increased quality and operating efficiency in missile manufacturing. We have the technical staff and the experienced engineers to design and install for you any requirement you may have for the application of heat to industry. Our service covers all types of heat treating furnaces, aluminum melting and holding furnaces, high frequency units, ceramic kilns, controls and all facilities required to fit this equipment into your production processes. We specialize in "turn-key" operations covering everything from design and engineering to the finished job installed in your own plant. Whatever your industrial heating problem, a good way to solve it is to talk it over with Lindberg. Just get in touch with your local Lindberg Field Representative (See classified phone book) or write Lindberg Industrial Corporation, 2321 West Hubbard St., Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Avenue, at Downey, California.



LINDBERG heat for industry

GREAT NAMES IN INDUSTRY produce MORE for LESS with PEECO

The story at PEECO can best be paraphrased — "... known by the company they keep ..." The long list of companies that now 'produce more', because PEECO vibratory feeders are engineered to work, reads like America's industrial "Who's Who". PEECO'S technical knowledge in parts feeding can help you schedule one or more parts at a given rendezvous at a predetermined rate per hour and oriented to the exact position desired. Obviously this generates great savings. Let PEECO sales engineers help you 'produce more'. Send for new literature on the latest feeding technique.

PEECO FEEDS THEM ALL

Time and Time again PEECO helps men in industry produce more . . . Why not you?

AUTOMATION DEVICES INC.
32nd and BRANDES STS., ERIE, PA. • PH 4-6320

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF VIBRATORY PARTS FEEDERS

FOR FURTHER INFOMATION, USE READER SERVICE CARD; INDICATE A-8-202-1

Drive SET-UP COSTS Down!

Making set-ups for tapping and reaming can be done with Ziegler Tool Holders at a lower labor cost than with ordinary tool holders for the simple reason that it takes less time with a Ziegler.

Just align the work to within 1/32" of accuracy on the radius (1/16" on the diameter) and the job is done—because the Ziegler Holder automatically compensates for the inaccuracy.

If you have never used a Ziegler, a big surprise awaits you the first time you give it a trial.

Types to fit any machine used for

PROMPT DELIVERY

W. M. ZIEGLER TOOL CO.
roller drive floating tool-holders
13566 Auburn • Detroit 23, Michigan

USE READER SERVICE CARD; INDICATE A-8-202-2

CAMS

ALL TYPES TO YOUR SPECIFICATIONS A COMPLETE SERVICE

Cylindrical contour duplicating work. We can also make your irregular shaped parts at a definite saving to you.

Our engineers will be happy to review your prints and specifications with you—no obligation, of course.

Also a complete service on your special machine and tooling requirements.

For your next cam order—special machine or tooling job—give us a trial.

SHAKER TOOL & DIE CO.
1080 E. 222 St.
Cleveland 17, Ohio IVanhoe 6-0900

USE READER SERVICE CARD; INDICATE A-8-202-3

DYKEM STEEL BLUE®

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-8-202-4

AVAILABLE NOW—ASTE COLLECTED PAPERS, 1958

Mail Your Order Today

The following sets of papers delivered at the 26th Annual Convention of the American Society of Tool Engineers in Philadelphia, May, 1958 are ready for immediate distribution.

COLLECTED PAPERS, Vol. 58, Book 1 ..... $10.00*

(This set contains the following:)

	Paper No.
Magnesium in Aircraft Tooling	46
The Tool Engineer's Approach to the B-58 Weapon System	47
Weight Savings in the Manufacture of Aircraft Engine and Missile Parts by Cold Roll Forming from Thick to Thin Materials	51
Safety Engineering as a Function of Human Engineering	52
For Tools and Dies—New Epoxy Fiber Compositions	55
Our Experience in the Use of Plastic for Making of Duplicate Die Models, Engineering Checking Fixtures and Prototype Tools	56
Shell Molding and Tool Engineering	57
Design Features and Cost Benefits of Hot Extruded Cold Drawn Steel Sections	62
Steel Forgings, Why and How	63
Standardization in the Nuclear Industry	64
Unique Aspects of Nuclear Component Manufacture	65
Tool Steel Toughness—Rated by a New Method of Measurement	66
Basic Developments in Carbide Tooling	67
New Developments in High Velocity Machining	68
Characteristics and Experimental Performance of Certain New Ceramic Tool Compositions	69
Role of Research and Development in Gear and Spline Production Equipment	70
Research Report on High Speed Circular Sawing of Aluminum Alloys	71
Static Switching for the Mechanical Engineer	73
Vitrifiable Silicate Tooling for High Temperature Plastics	74
Mechanism of Chip Formation in Metal-Cutting	75
Some Thermal and Physical Aspects of Metal-Cutting	76
Gear Tooth Honing—A New Approach to Improving Gear Surface Finish	77
Obtaining Specified Finishes by Honing	78
Present Knowledge of Cutting Fluids	79
Influence of Metallurgical Properties on Metal-Cutting Operations	80
New Manufacturing Techniques for Hydraulic Servo Valves	81
The Use of Ultra High Speed 150 Horsepower Lathe for Machinability Studies	82
Metal-Cutting Research Panel	83
A New Appproach to Some Relationships in the Theory of Metal-Cutting	86
Machine Tool Dynamometers, Their Design and Application	87
Automatic Size Control for Centerless Grinders	88
The Significance of the Surface Finish Produced by Electrodischarge Machining	89
Oriented Diamonds in Connection with Single Point Tool Applications	92
Proper Grain Orientation Improves Diamond Cutting Tool Life	93
A Production Engineer Looks at Missile Design	94
A Missile Designer Looks at Production	95
Oriented Diamonds Give Maximum Performance in Formed Dressing Tools	99
The Oriented Vector in Diamond Dressing Tools	100
The Spiral Point Drill—A Self-Centering Drill Point Geometry	101
Production Drilling and Reaming of Precision Holes with Gun-Type Tools	102
A Rapid Method for Setting Oriented Diamonds in Tools	103
The Orientation of Diamonds for Tools by Means of an X-Ray Image Intensifier Tube	104
Recent European Metal-Cutting Investigations	112
Tool Engineering in Europe	113
Machinery and Automation	116
Automation—The Manufacturing, Sales, Engineering Triangle	117
On Machining Titanium	118
Design Considerations for Cold Extrusion of Titanium	119
Cutting Tool Materials of the Future	120
Today's Cutting Tool Materials	121
Types of Automatic Assembly Equipment	122
Automatic Manufacturing with the Integrated Line	123
Gaging Screw Threads for Acceptability	124
Frictional Behavior of Metals and Plastics	125
High Production Automation Thru Low Speed Mechanisms	126
Application of Weldamation Techniques to Welding Processes	127
Capacity of Lathe Chucks	128
What Will Mechanical Tool Holders Do for You?	129
Economic Advantages of Progressive Dies	130
Automation Panel	131

(and the COLLECTED PAPERS includes the following papers of the METAL-CUTTING REVIEW SEMINAR available as a separate book @ $6.00*)

	Paper No.
Economic Importance of Chip Making	43
What is Known Today About Metal-Cutting	44
Metal-Cutting Forces	45
Cutting Tool Geometry	48
Machinability Testing	49
Cutting Fluids	50
Tool Life	53
Microstructure as it Affects Machinability	54
Single Point Turning	58
Drilling Technology	59
Milling Practice Today	60
Tool Grinding	61
Metal-Cutting Review Seminar Panel	72

(and it includes the following papers of the NUMERICAL CONTROL SYMPOSIUM available as a separate book @ $6.00*)

	Paper No.
Numerical Control: Facts and Fallacies	84
Numerical Control	85
Machine Tool as the Controlled Element	90
Potentials of Numerical Control in Manufacturing Operations	91
Numerical Control for Templates and Dies	96
Production Experience on Numerically Controlled Machine Tools	97
Contouring Control from Numerical Data	108
The Tool Engineer and Tape Preparation	109
Numerical Control—First Year Statistics	110
Programming for Numerical Control	111

(and the following papers of the METAL POWDER PARTS SYMPOSIUM available as a separate book @ $6.00*)

	Paper No.
The Effects of Structural Part Design on Tooling for Sintered Metals Fabrication	98
Presses for Powder Metallurgy	105
Briquetting Tools	106
Metal Powders and The Tool Engineer	107
Sintering Structural Parts	114
Finishing Operations	115

NOTE: Individual papers may be ordered at $1.00* each by circling paper numbers desired. MINIMUM ORDER $1.00.

Collected Papers, Department 5
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Please send postpaid the following as checked:

☐ COLLECTED PAPERS, Vol. 58, Book 1 @ $10.00*
☐ METAL-CUTTING REVIEW SEMINAR @ $6.00*
☐ NUMERICAL CONTROL SYMPOSIUM @ $6.00*
☐ METAL POWDER PARTS SYMPOSIUM @ $6.00*

* ASTE MEMBERS DEDUCT 50%

Name .....

Address .....

.....

City ..... Zone ..... State .....

MEMBER ☐ CHAPTER NO. ..... NONMEMBER ☐

FULL PAYMENT OR COMPANY PURCHASE ORDER MUST ACCOMPANY ALL ORDERS

Index of THE TOOL ENGINEER Advertisers

August 1958

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1958 ASTE Industrial Exposition

♦Subscriber to ASTE Data Sheet Service

A

Acme Industrial Co. ... 199
Air-Mite Devices, Inc. ... 172
*Alina Corp. ... 126
Allegheny Ludlum Steel Corp. ... 10
Allen Mfg. Co. ... 158
*American Brake Shoe Co., Denison Engineering Division ... 166
♦*American Chain & Cable Co., Inc., Wilson Mechanical Instrument Division ... 194
♦*American Drill Bushing Co. ... 17
*American Society of Tool Engineers ... 187, 203
American Tool Works Co., The ... 8
Apex Broach Co. ... 143
Armstrong-Blum Mfg. Co. ... 144
Atrax Co., The ... 135
Automation Devices, Inc., Perry Equipment & Eng. Division ... 202

B

Balas Collet Mfg. Co. ... 206
*Barber-Colman Co. ... 26-27
*Bausch & Lomb Optical Co. ... 36-37
Bay State Tap & Die Co. ... 171
Behr-Manning Co. ... 179
Bellows Co., The ... 161
Benchmaster Mfg. Co. ... 196
Bentley Industrial Corp. ... 148
Bethlehem Steel Corp. ... 183
*Black Drill Co. ... 182
Blanchard Machine Co., The ... 34
*Bliss, E. W., Co. ... 189
Bodine Corp., The ... 9
Bullard Co., The ... 198

C

*Carpenter Steel Co., The ... 136
*Carr Lane Mfg. Co. ... 205
Central Safety Equipment Co. ... 172
*Cerro de Pasco Sales Corp. ... 188
Chicago Rivet & Machine Co. ... 155
Cincinnati Milling Machine Co., The, Grinding Machine Division ... 11
Cincinnati Milling Machine Co., The, Heald Machine Co., Subsidiary ... Inside Front Cover
*Circular Tool Co. ... 123
♦ Clearing Machine Corp., Division U. S. Industries, Inc. ... Back Cover
Cone Automatic Machine Co., Pilot Division ... 163
*Cushman Chuck Co. ... 157

D

*Denison Engineering Division, American Brake Shoe Co. ... 166
*Detroit Reamer & Tool Co. ... 154
*DeVlieg Machine Co., Jigmill Division ... 168-169
Microbore Division ... 13
♦*DoALL Co. ... 177
♦*Dow Chemical Co., The ... 180
Dykem Co., The ... 202

E

*Eastern Machine Screw Corp., The ... 126
*Eastman Kodak Co. ... 159
*Engelberg, Inc. ... 142
Ex-Cell-O Corp. ... Inside Back Cover

F

Fiske Bros. Refining Co. ... 188
Foote-Burt Co., The ... 22

G

*Gaertner Scientific Corp. ... 140
*Galland-Henning Mfg. Co., Nopak Division ... 146
General Motors Corp., Oldsmobile Division ... 190
Gisholt Machine Co. ... 12
Greaves Machine Tool Co. ... 129
Greenlee Bros. & Co. ... 29-32

H

*Handy & Harman ... 132
*Hanna Engineering Works ... 167
Hardinge Brothers, Inc. ... 5
♦ Hartford Special Machinery Co. ... 186
Heald Machine Co., Subsidiary, Cincinnati Milling Machine Co. ... Inside Front Cover
High Standard Mfg. Corp., The ... 162
Hy-Pro Tool Co. ... 18

J

Jahn, B., Mfg. Co., The ... 115
Joslyn-Hudson Corp. ... 134

K

Kearney & Trecker Corp. ... 164-165
*Kennametal, Inc. ... 200

L

♦*Lapeer Mfg. Co. ... 147
Lee, K. O., Co. ... 170
*Leland-Gifford Co. ... 176
Lepel High Frequency Laboratories ... 125
Lindberg Engineering Co. ... 201
*Lodding, Inc. ... 119
*Logansport Machine Co. ... 175
*Lovejoy Tool Co. ... 130

M

Magnetics, Inc. ... 160
Marcellus Mfg. Co. ... 162
McKay Machine Co. ... 181
♦ Meyers, W. F., Co. ... 178
♦*Micrometrical Mfg. Co. ... 141
*Milford Rivet & Machine Co., The ... 127
*Modernair Corp. ... 170
Morse Twist Drill & Machine Co., Subsidiary, Van Norman Industries, Inc. ... 14-15
*Motch & Merryweather Machinery Co., The ... 21

N

*National Acme Co., The ... 184
♦ National Twist Drill & Tool Co. ... 6-7
New Britain Machine Co., The ... 195
*Nikon, Inc. ... 156
*Nopak Division, Galland-Henning Mfg. Co. ... 146

O

*Ohio Crankshaft Co., Inc. ... 38
Oldsmobile Division, General Motors Corp. ... 190
Olkon Corp. ... 148
Olofsson Corp. ... 150
*Oisen, Tinius, Testing Machine Co. ... 178
♦*Ortman-Miller Machine Co. ... 114

P

Perry Equipment & Eng. Division, Automation Devices, Inc. ... 202
Pilot Division, Cone Automatic Machine Co. ... 163

Pioneer Aluminum, Inc. 197
Pipe Machinery Co. 28
Putnam Tool Co. 121

R

*R and L Tools, Inc. 174
*Reichhold Chemicals, Inc. 192
*Robbins, Omer E., Co. 124
Rockford Clutch Division, Borg-Warner Corp. 131
*Russell, Holbrook & Henderson, Inc. 16
*Ryerson Steel Co. 40

S

*Service Machine Co. 182
Shaker Tool & Die Co. 202
Shell Chemical Corp. 35
Shell Oil Co. 185
Southwest Products Co. 188
*Standard Pressed Steel Co. 20
Standard Tool Co. 33
*Stone Machinery Co. 182
*Sun Oil Co. 2
Sundstrand Machine Tool Co., Sundstrand-Arter Grinding Division 24-25
*Superior Steel Products Corp. 191

T

Thompson Grinder Co. 19
*Thor Power Tool Co. 116
Threadwell Tap & Die Co. 4
Thriftmaster Products Corp. 162
*Tinius Olsen Testing Machine Co. 178
♦*Tomkins-Johnson Co. 120
*Torit Mfg. Co. 128

U

♦ U. S. Industries, Inc., Clearing Machine Corp., Division ..... Back Cover
*U. S. Tool Co., Inc. 173
*Universal Engineering Co. 193

V

Van Norman Industries, Inc., Morse Twist Drill & Machine Co., Subsidiary 14-15
*Vanadium-Alloys Steel Co. 23
*Vascoloy-Ramet Mfg. Corp. 112
*Vulcan Tool Co. 153, 170

W

*Wales-Strippit Co. 145
Wallace Supplies Mfg. Co. 172, 178, 205
♦*West Point Mfg. Co. 196
*Whistler, S. B., & Sons, Inc. 196
♦*Wilson Mechanical Instrument Division, American Chain & Cable Co. 194
Winter Brothers Division, National Twist Drill & Tool Co. 6-7

Y

Yoder Co., The 152

Z

Ziegler, W. M., Tool Co. 202

THE TOOL ENGINEER REGIONAL ADVERTISING OFFICES

EASTERN
Austin G. Cragg
Frank Baldwin
400 Madison Ave.
New York 17, N. Y.
PLaza 9-4018

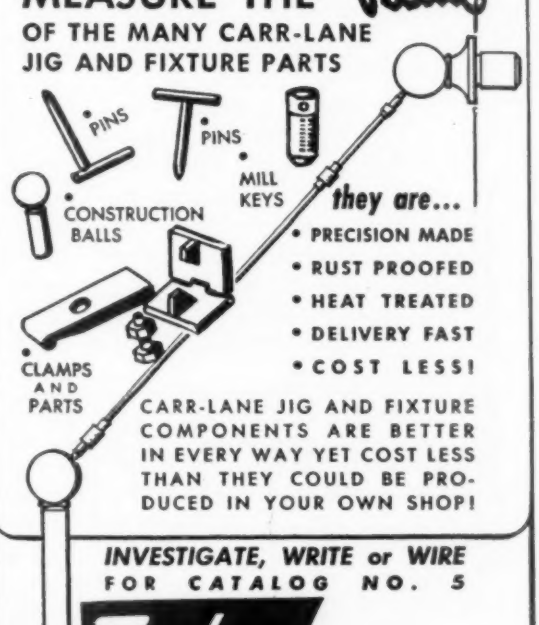
OHIO
Richard E. Cleary
15515 Detroit Ave.
Cleveland 7, Ohio
LAkewood 1-7125

CENTRAL
Clarence T. Etter
R. Alan Cobleigh
10700 Puritan Ave.
Detroit 38, Mich.
UNiversity 4-7300

WESTERN
Stanley F. Girard
Room 217
612 North Michigan Ave.
Chicago 11, Ill.
Michigan 2-4465

PACIFIC COAST
Robert E. Ahrensdorf
5720 Wilshire Blvd.
Los Angeles 36, Calif.
WEbster 8-3881

MEASURE THE Value
OF THE MANY CARR-LANE JIG AND FIXTURE PARTS



they are...
• PRECISION MADE
• RUST PROOFED
• HEAT TREATED
• DELIVERY FAST
• COST LESS!

CARR-LANE JIG AND FIXTURE COMPONENTS ARE BETTER IN EVERY WAY YET COST LESS THAN THEY COULD BE PRODUCED IN YOUR OWN SHOP!

INVESTIGATE, WRITE or WIRE FOR CATALOG NO. 5

Carr Lane MANUFACTURING CO.
4200 KRAUSE COURT • ST. LOUIS 19, MO
USE READER SERVICE CARD; INDICATE A-8-205-1

are your bending methods up to date?

LEARN HOW OTHERS ARE DOING IT NOW

You will see how other people use ram — rotary — roll benders in their plants. 36 pages written *in layman's language* . . . with in-plant pictures. Also letters from users.

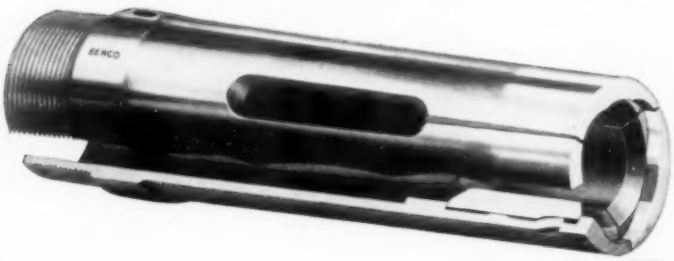
Write today for your free copy

WALLACE SUPPLIES MFG. CO.
1304 W. Wolfram Chicago 13, Illinois
USE READER SERVICE CARD; INDICATE A-8-205-2

PROVEN LONGER LIFE
PROVEN BETTER PRODUCTION

BENCO

model "A" master pushers with carbide pusher pads



You get more and better output with Benco Model "A" Master Pushers and carbide pads. Production runs in excess of 5,000,000 pieces have been achieved without changing pads or loss of tension of pushers.

Designed with "rocking ridge" in the pad recess, the Model "A" Master Pusher permits the pads to adjust themselves to full bearing on the stock. Thus scoring of the stock is avoided and feeding becomes more accurate. You will reduce your cost and get better production with Benco Model "A" and carbide pusher pads because no wear appears on the feed pad, therefore, no change in tension results and pusher troubles are eliminated.

For long life, for unmarked stock, Benco carbide pusher pads will far exceed the performance of any similar tool. The extremely low prices of carbide pusher pads will be returned to you many times in the savings they effect. You simply can't afford to be without them. For your short run jobs, very inexpensive pads are available for these master pushers in bronze, cast iron, hardened steel and meehanite.

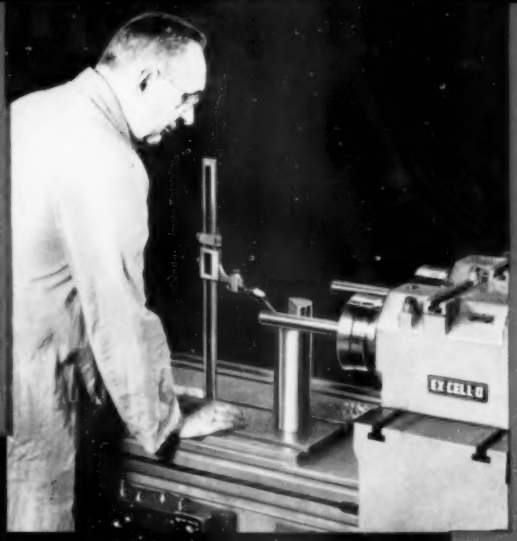
Most sizes of Solid and Master Pushers, Solid and Master Collets for all popular automatics will be delivered immediately from stock. Send for price list and catalog.

BENCO COLLET manufacturing company

Cleveland 14, Ohio

XLO

EX-CELL-O
FOR PRECISION



The same skill, care and precision that goes into the building of a new machine is duplicated in renewal or repair of older machines by the men who know Ex-Cell-O Precision Machines best.

58-39

Are you ready for the business upsurge?

RENEW YOUR EX-CELL-O MACHINES NOW!

Better business is just around the corner, and now's the time—when your present Ex-Cell-O equipment may not be in continuous service—to release idle machines for renovation before full production begins once more.

Ex-Cell-O's facilities for machine repair or renewal are geared to your specific needs—whether it's a planned modernization program or an emergency repair job. The service is fast, the workmanship thorough; and, of course, necessary replacements are Ex-Cell-O "original equipment" precision parts.

For complete satisfaction and guaranteed results, put your Ex-Cell-O machines in the hands of the men who know them best. Contact your local Ex-Cell-O Representative, or call direct for complete details.

EX-CELL-O CORPORATION *Machinery Division*

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

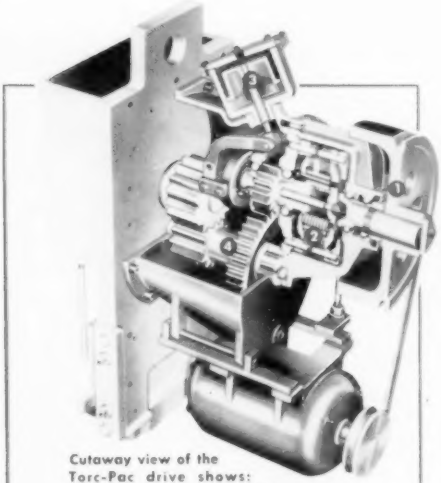
Torc-Pac-Clearing's New Line of O.B.I.'s

at prices that will amaze you!

22 ton press, **$1,395**

32 ton press, **$2,635**

45 ton press, **$3,445**



Cutaway view of the Torc-Pac drive shows: 1. Flywheel 2. Air Friction clutch and brake 3. Air cylinder actuator 4. Reduction gearing.

COMPLETE AND READY TO RUN

A quality O.B.I. press, complete and ready to run, designed to sell at an economical price . . . . this was the challenge handed to Clearing Engineers early last year. The Torc-Pac line of O.B.I.'s is their answer. This line is *your* answer also, to rising production costs. Torc-Pac O.B.I.'s will provide efficient high speed production, year in, year out, virtually without maintenance problems.

AIR FRICTION CLUTCH AND BRAKE—A unique, new design using sintered bronze friction plates operating in oil permits extremely rapid single stroking. Adjustment is never required.

UNITIZED TORC-PAC DRIVE—Entire drive from motor to slide is demountable as a unit from press frame, and interchangeable with other Torc-Pac Presses.

ALL STEEL WELDED FRAME—Sturdy all steel frame is designed for low deflection, clean appearance, convenience of operation.

COMPLETE ELECTRICAL CONTROLS—Ready to run, including motor starter, selector switch and run and stop buttons.

The many important features of Clearing Torc-Pac presses are described and illustrated in this brochure. Write for it today.

CLEARING PRESSES

the way to efficient mass production

CLEARING MACHINE CORPORATION—*division of* ***U.S. INDUSTRIES, INC.***

6499 W. 65th Street • Chicago 38, Illinois / Hamilton Plant • Hamilton, Ohio